

5. CUMULATIVE IMPACTS

Council on Environmental Quality (CEQ) regulations require an assessment of potential cumulative impacts. Cumulative impact is defined by those regulations at 40 CFR 1508.7 as:

the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Cumulative impacts for each affected resource are assessed in this section. The discussion of potential cumulative impacts assumes the successful implementation of the environmental protection and mitigation measures described in **Appendix C** and **Chapter 4** of this EIS, as well as compliance with the Rawlins RMP and all applicable federal, state, and local regulations and permit requirements. The analysis of cumulative impacts addresses both potentially adverse and beneficial impacts.

The cumulative impact analysis area for the CD-C project generally includes south-central Wyoming but is variable for each resource. No single geographic unit would serve as a cumulative impact analysis area for all resources. The Air Quality analysis, for example, analyzes cumulative impacts over an area that includes all of southwestern Wyoming and parts of Colorado, Utah, and Idaho. The Geology cumulative analysis, on the other hand, is concerned only with the CD-C project area itself. For the cumulative analysis in this draft EIS, each resource analysis includes a definition of the area considered in its cumulative impact analysis.

The cumulative impact analysis has an estimated future timeframe of 45 years—the 15-year period of development plus the 30- to 40-year operational life of a producing well. As with the impact analysis area, the time frame for cumulative impact analysis will vary from one resource to another. Each resource analysis section describes the approximate time frame during which cumulative effects would occur.

The “past, present, and reasonably foreseeable future actions” most commonly associated with the CD-C project area and south central Wyoming in general are grazing, transportation, and natural gas development. Livestock grazing—both sheep and cattle—began in the 1870s, continues today, and is expected to continue into the future. Sheep numbers have declined from their peak in the early part of the 20th century but cattle numbers remain high.

The area has been traversed by trails since humans first came to the area, and today includes major east-west and north-south transportation and utility corridors used for roads, railroads, and pipelines. The Overland and the Cherokee Trails—historic passageways—cross the area. The first transcontinental railroad, the Union Pacific, came to the area in the 1860s and still operates today, with heavy freight traffic crossing east and west. The nation’s first transcontinental highway, the Lincoln Highway, was built in the same corridor as the railroad in the early part of the 20th century. It has been replaced by Interstate 80 (I-80), which will remain a major east-west transportation route into the future. WY 789 and several county roads are the main north-south routes in the area. The Wamsutter hub is a major connection point for the many natural gas pipelines that traverse the area east-west and north-south.

Natural gas development in the CD-C project area and the surrounding area has been ongoing since the 1950s. The Wamsutter field, the first natural gas field in the area, was established in 1958. Since then, the rate of development has varied but has proceeded at the rate of about 200 wells per year since 2008. Prior development and existing activities within the project area are described in the introduction to Chapter 4, Environmental Consequences (**Section 4.0.1**). The 47,200 acres of new surface disturbance anticipated by the CD-C Natural Gas Development Project would be added to 56,647 acres of surface disturbance that has already occurred within the area. The CD-C project impacts for each of the resources and activities

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discussed in Chapter 4 are described in the context of those disturbances and impacts that have already occurred in the project area. Those discussions will not be repeated here. There are other defined areas in south-central Wyoming—the Atlantic Rim and the Hiawatha project areas, for example—where natural gas has historically been produced and will continue to be produced. Those will be discussed in this section to the extent that they are relevant. **Table 5.0-1** describes the principal natural gas projects that are ongoing or that are in planning. **Map 5.0-1** shows energy development projects that are ongoing or in the planning stage.

In addition to natural gas activities, **Table 5.0-1** also describes reasonably foreseeable future wind energy development projects, mining activity, and major electric transmission lines and industrial development projects.

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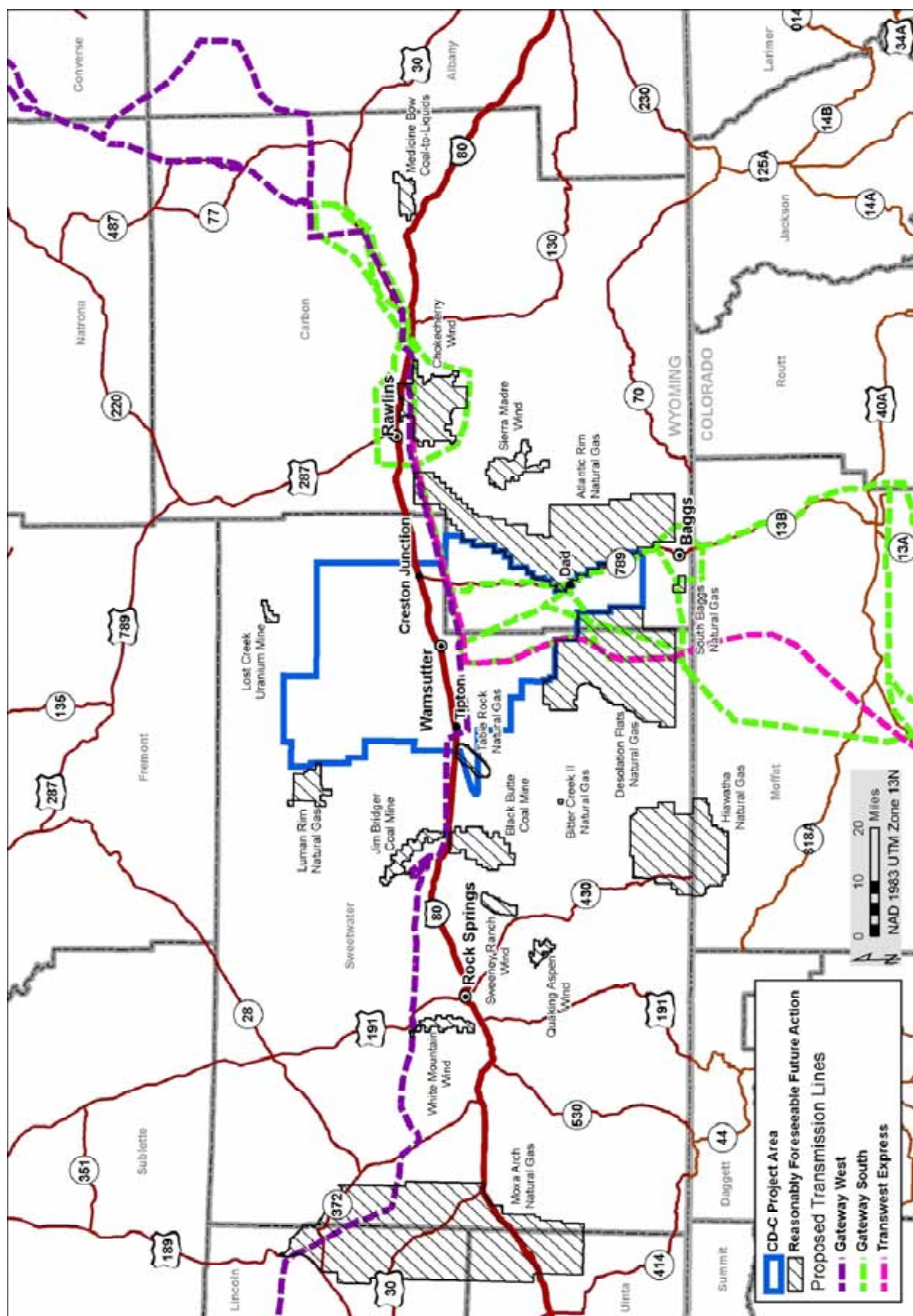
Table 5.0-1. Ongoing and Reasonably Foreseeable Future Actions (RFFAs)

Project	Proponent	Location	County	Development Schedule	Scale
Natural Gas					
Atlantic Rim Natural Gas Field Development	Anadarko Petroleum Corporation and others	East of and adjacent to CD-C project area	Carbon	2007–2027	2,000 wells/270,080 acres
Beaver Creek Natural Gas Development Project	Devon	9 miles southeast of Riverton	Fremont	2013–2023	228 wells/16,515 acres
Bitter Creek Shallow Oil and Gas Project	Infinity / Yates Petroleum	30 miles east of Rock Springs between Bitter Creek and Point of Rocks	Sweetwater	2005–2009	61 wells/17,961 acres
Desolation Flats Natural Gas Development Project	Marathon Oil and others	Southwest of and adjacent to CD-C project area	Sweetwater/Carbon	2004–2024	385 wells/233,542 acres
Gun Barrel, Madden-Deep, Iron Horse (GMI) Natural Gas Development Project	EnCana Oil & Gas, Burlington Resources and Noble Energy	60 miles west of Casper	Fremont/ Natrona	2013–2043	3,500 wells/500,000 acres
Hiawatha Regional Energy Development Project	Questar/ Wexpro	65 miles southeast of Rock Springs	Sweetwater/Moffat CO	2013–2043	2,200 wells/157,361 acres
LaBarge Gas Exploration and Development Project	EOG Resources, Inc and others.	65 miles northwest of Rock Springs	Lincoln/ Sublette	2013–2023	838 wells/218,000 acres
Luman Rim	Yates Petroleum and others	Northwest of and adjacent to CD-C project area	Sweetwater	2011–2021	58 wells/19,548 acres
Moxa Arch Area Infill Gas Development Project	BP America and others	Northeast of Fort Bridger	Uinta/Lincoln/ Sweetwater	2013–2043	1,860 wells/476,300 acres
Normally Pressured Lance Natural Gas Development Project	EnCana and others	Immediately southwest of the Jonah Field	Sublette	2014–2026	3,500 wells/141,080 acres
Table Rock Unit Oil and Gas Development	Chevron U.S.A.	40 miles east of Rock Springs (partly in CD-C)	Sweetwater	2013–2027	88 wells/13,633 acres
Wind Energy					
Bridger Butte Wind Energy Project	Bridger Butte Wind Power LLC	West of Fort Bridger	Uinta	2021–	120 turbines/13,286 acres
Chokecherry and Sierra Madre Wind Energy Project	Power Company of Wyoming	South of Rawlins	Carbon	2012–2015	1,000 turbines/215,000 acres
Sweeney Ranch Wind Park	Sweeney Ranch Wind Park, LLC	15 miles southeast of Rock Springs	Sweetwater	2013–2016	150 turbines/5,360 acres
White Mountain Wind Farm	Teton Wind	Near Rock Springs	Sweetwater	2012–2018	240 turbines/ 13,165 acres

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Table 5.0-1. Ongoing and Reasonably Foreseeable Future Actions, *continued*

Project	Proponent	Location	County	Development Schedule	Scale
<i>Wind Energy, continued</i>					
Quaking Aspen Mountain Wind Farm	Evergreen Wind Power Partners, LLC	11 miles SE of Rock Springs	Sweetwater	Unknown	38 turbines/ 5,157 acres
<i>Transmission Lines</i>					
Gateway West Transmission Line Project	Idaho Power and Rocky Mountain Power Companies	Glenrock, Wyoming to Melba, Idaho	Converse/ Albany/ Carbon/ Sweetwater and west	2014–2018	~500 miles
Gateway South Transmission Line Project	Rocky Mountain Power Company	Medicine Bow, Wyoming to Mona, Utah	Converse/ Albany/ Carbon/ and southwest	2017–2020	~400 miles/250' ROW
TransWest Express Transmission Line Project	TransWest Express (Anschutz subsidiary)	Sinclair, Wyoming to southern Nevada	Carbon and southwest	2013–2016	~600 miles 250' ROW
<i>Mining</i>					
Lost Creek In Situ Uranium Project	UR Energy (Lost Creek ISR LLC)	15 miles southwest of Bairoil	Sweetwater	2011-2024	4,250 acres
Bridger Mine Expansion	Idaho Energy Resource Company/Pacific Minerals	North of Point of Rocks	Sweetwater	2011–2031	To keep mine operating at current level
<i>Other</i>					
Medicine Bow Fuel & Power Coal-to-Liquids Project	Medicine Bow Fuel & Power	South of Medicine Bow	Carbon	2014–	20,000 bbl/day



Map 5.0-1. Reasonably foreseeable future actions in the cumulative impact analysis area

No warranty is made by the BLM for use of the data for purposes not intended by the BLM.

■ PHYSICAL ENVIRONMENT

5.1 GEOLOGY

The cumulative impact analysis area (CIAA) for geology is the CD-C project area. Geologic resources are not expected to be impacted by activities that occur outside the project area nor would implementation of CD-C project activities have impact outside the area. Cumulative impacts would be limited to past and ongoing oil and gas extraction, grazing, and transportation activities within the project area. Geological resources have not been significantly affected by past and continuing activities in the project area and are not expected to be notably affected by any future activities if mitigation measures described in **Appendix C** are implemented.

5.2 PALEONTOLOGIC RESOURCES

The CIAA for paleontology is the CD-C project area. Paleontological resources are not expected to be impacted by activities that occur outside the project area. Cumulative impacts would be limited to past and ongoing oil and gas extraction, grazing, and transportation activities within the project area. Paleontological resources have not been significantly affected by past and continuing activities in the project area and are not expected to be notably affected by any future activities if mitigation measures described in **Appendix C** and **Section 4.2.5, Unavoidable Adverse Impacts and Additional Mitigation Measures**, are implemented.

5.3 SOILS

The CIAA for soils is the CD-C project area. Past, present, and future actions would incrementally increase soil disturbances and soil productivity for the lifetime of development and gas production in the project area, approximately 45 years. The cumulative losses for soil resources would occur due to 47,200 acres of new surface disturbance in addition to 60,176 acres of historic surface disturbance related to natural gas development and other activities. The increased surface disturbance for the Proposed Action would represent a 78-percent increase relative to that for historic development, although the impacts would be mitigated by successful implementation of interim and final reclamation during the life of the project. The 47,200 acres of new disturbance under the Proposed Action is approximately 44 percent of the cumulative disturbance for the project area soils.

Impacts to soils in the project area related to the Proposed Action and various alternatives are described in **Section 4.3.3** of the EIS. Post-reclamation disturbances for the Proposed Action and various alternatives would be relatively low and successful reclamation would reduce the cumulative impacts to the soil resource that may result from the Proposed Action or the alternatives. Impacts to soil productivity, vegetation, and surface water would be more severe during development and production and would diminish during final reclamation and the post-reclamation phase of the project. Implementation of Best Management Practices (BMPs) to reduce erosion and sedimentation and promote revegetation would be used to reduce cumulative impacts.

Cumulative impacts to project area soils include past, present, and future actions that would affect surface-water quality due to erosion and sediment discharge, and increased surface disturbances that reduce soil productivity prior to successful reclamation. The geographic area of soils-related cumulative impacts includes surface disturbances within the project area in addition to the water quality related impacts.

The northern 70 percent of the project area is located in the Great Divide Basin, a closed basin which is bounded by the Continental Divide. Impacts from erosion and sediment within the basin are generally low and dependent upon localized soils and terrain. Since surface water would not discharge outside of the

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closed basin, impacts from erosion and sediment would not affect any other watershed. Future actions that would result in cumulative impacts within the Great Divide Basin include the Luman Rim Natural Gas Development located northwest of and adjacent to the project area.

The southern portion of the project area is primarily drained by Muddy Creek and its tributaries which are part of the Little Snake River Basin. The Muddy Creek Sub-basin has been historically impacted and is listed in the 2010 Wyoming 303(d) List as either not supporting or threatened for aquatic life, non-game fish and cold-water game fish (WDEQ 2010). Unstable stream channels and loss of riparian function have occurred throughout the basin due to season-long riparian grazing and accelerated erosion associated with oil and gas activities. In upper Muddy Creek the Little Snake River Conservation District (LSRCD), BLM, landowners, grazing permittees, Wyoming Game and Fish (WGFD), and other stakeholders have been involved in Coordinated Resource Management since 1992 including several Section 319 watershed improvement projects. These projects have included upland water development, cross fencing, and vegetation and grazing management. Deferred grazing has also been implemented in the Grizzly Wildlife Habitat Management Area to promote restoration of watershed function. LSRCD and WGFD data indicate that improvement to stream stability, aquatic habitat and riparian areas has resulted from both of these projects and several reaches in Muddy Creek, Littlefield Creek, and McKinney Creek are meeting their aquatic life uses and have been removed from the 303(d) list. These projects are located in the Upper Muddy Creek Drainage outside of the project area.

The LSRCD and other stakeholders have also implemented another watershed improvement project to address physical degradation of the Muddy Creek stream channel, which threatens aquatic life-use support. This project is located along Muddy Creek on the west side of WY 789 in the project area and includes wetlands development, reestablishment of the floodplain and irrigation water management. This project has resulted in improving trends in riparian condition and bank stability.

Future actions that would result in cumulative impacts to the Proposed Action within the Muddy Creek Sub-basin include the Desolation Flats Natural Gas Development Project located adjacent and southwest of the project area, and the Atlantic Rim Natural Gas Field Development located east of and adjacent to the project area.

5.4 WATER RESOURCES

The CIAA for water resources includes two components: (1) an analysis of cumulative impacts within the CD-C project area and (2) an analysis of cumulative impacts on portions of the watersheds that are associated with the CD-C project area. The cumulative surface water impacts analysis area includes portions of the White-Yampa, Great Divide, and the Upper Green drainage basins. The cumulative groundwater impact analysis area includes portions of the Green River, Great Divide, and Washakie structural basins, the Rock Springs and Rawlins uplifts, and the Wamsutter Arch. Cumulative impacts include water resource impacts from past, present, and reasonably foreseeable future oil and gas developments, agriculture (irrigated crops, livestock grazing, and ranch management), recreational activities/vehicular traffic, and other mining and industrial activities.

5.4.1 Cumulative Impacts Common to the CD-C Project-Specific and Watershed Analysis Areas

Surface Water. All action alternatives would result in increased natural gas development in the CD-C project area, with the difference between alternatives being the magnitude of disturbance. Including the CD-C project, there are 12 currently operating or planned oil and gas development projects within the CD-C larger watershed analysis area. The projects with the greatest potential to contribute to cumulative impacts to surface water resources would be the CD-C project and the Atlantic Rim Natural Gas Development Project. These projects are adjacent to Muddy Creek, which as discussed below, is under special protection by the State of Wyoming. Historic development in the project area accounts for 60,176

acres of initial disturbance and 17,663 acres of long-term disturbance. Total historic development in the watershed analysis area has not been calculated. The Proposed Action and the alternatives would add disturbance of between 36,499 acres (Alternative D) and 61,696 acres (Alternative A). The long-term disturbance would range from 14,952 to 24,133 acres. The main cumulative impacts to surface-water resources from oil and gas development would be brought about by contamination of surface water from both authorized and accidental surface discharge of fluids and the impacts (including sediment loading) from surface disturbance related to project development/maintenance. These cumulative impacts would be greatest within the CD-C analysis area but the contamination of surface water and off-site sedimentation would extend downstream of the CD-C watershed analysis area. As part of the Atlantic Rim project, Upper Muddy Creek is currently monitored for sediment delivery from eroding streambanks, measurement of habitat features and stream geomorphology, and measurement of sediment concentrations and other water quality parameters.

Agriculture (irrigated crops, livestock grazing, and ranch management) and other natural resource uses within the cumulative impact analysis areas would result in increased surface runoff, accelerated erosion, and off-site sedimentation that would cause channel instability and degradation of surface-water quality. Because livestock tend to concentrate around available sources of water (stock reservoirs, stock tanks associated with water wells, and flowing streams) there would be localized effects in these areas, which could lead to greater erosion where anthropogenic surface disturbances and livestock concentration areas overlap. Two portions of Muddy Creek, which is within the White-Yampa watershed (**Map 3.4-1**), are now listed on the State 303(d) list of Impaired or Threatened Waterbodies due to habitat alteration, primarily due to livestock grazing (WDEQ 2012) and exacerbated by oil and gas development. The Little Snake River Conservation District (LSRCD) has been working through a Coordinated Resource Management (CRM) process with the BLM, landowners, grazing permittees, WGFD, and other stakeholders since 1992 to address these water quality and riparian habitat problems. As part of the CRM process, LSRCD has managed several Section 319 watershed improvement projects in the upper Muddy Creek drainage. According to WDEQ, the projects have resulted in considerable improvement to stream stability, aquatic habitat and riparian health, especially in the upper Muddy Creek tributaries (WDEQ 2012). While the CRM process is no longer formally in place, the beneficial effects are still being realized. Although not agricultural in nature, accelerated erosion associated with oil and gas activities within the Muddy Creek sub-basin has been identified as having a role in exacerbating the degradation of lower Muddy Creek. Surface water impacts would be considered significant for at least one surface-water significance criterion through cumulative impacts if the Proposed Action or any of the action alternatives were selected. Cumulative surface water impacts would not be considered significant for Alternative E.

Recreational activities and vehicular travel would have minimal effects on surface water, but could be more pronounced in localized areas due to off-road travel and additional access provided by resource development. Off-road travel in drainage areas would cause local impacts to surface waters. Impacts could be more significant where there is continuous federal land and the project improves or creates new access. Recreational activities and off-road travel are not expected to have significant effects on surface-water resources and would not contribute to the significance impacts discussed in **Section 4.4.4**.

Other industrial activities (i.e., mining, wind energy development, and construction of power transmission lines) would impact surface-water quality in localized areas within the cumulative impact area. The proposed Gateway West, Gateway South, and TransWest Express transmission line projects would cross the cumulative impact analysis areas and would have the potential to affect surface water during construction, operation, and decommissioning of the projects, particularly where the transmission corridors cross drainages. The BLM is the lead federal agency for the NEPA process for these proposed projects.

Groundwater. As discussed in **Section 5.0**, natural gas development in the project area and the surrounding region has been ongoing since the 1950s. Since initiation of drilling, over 4,400 natural-gas wells have been drilled. All of the action alternatives would result in the same number of new wells

drilled (8,950 natural gas and 30 injection), with the difference being the number of well pads and the extent of required access roads and pipelines needed for resource development. Cumulative groundwater impacts would occur during the removal of groundwater; from improper drilling operations; from accidental releases of fluids (spills) associated with drilling and fracturing operations, produced water, and other hazardous liquids to soils and surface-water systems; and through subsurface disposal (injection) of produced water. These impacts are the same as the project specific impacts described in **Section 4.4.4**. Cumulative groundwater impacts are not expected to be significant and would not contribute to the significance impacts discussed in **Section 4.4.4**.

5.4.2 Cumulative Impacts within the CD-C Project Area

Surface Water. The types of cumulative surface-water impacts would be the same as those discussed in **Section 5.4.1**. Disturbance related to current oil and gas development has already occurred. Cumulative impacts, particularly from the CD-C and Atlantic Rim projects, would exacerbate current degradation on Muddy Creek. Since the CD-C project would be the largest contributor to cumulative impacts, successfully utilizing BMPs and COAs listed in **Appendix C** would reduce the potential for adding to cumulative impacts. Surface water impacts would be considered significant for at least one surface-water significance criteria through cumulative impacts if the Proposed Action or any of the action alternatives were selected. Surface water impacts would not be considered significant for Alternative E.

Groundwater. The types of cumulative groundwater impacts would be the same as those discussed in **Section 5.4.1**. Using the available estimates of water use included in the NEPA analyses of projects still in development within the project area, the total cumulative water demand over the lives of the projects would be 40,470 ac-ft (BLM 2004, 2005e, 2006a, 2007f, 2010d, and 2011b). This amount is approximately 0.4 percent of the estimated volume of producible groundwater available (9.67 million ac-ft) in the Tertiary-age aquifers underlying the project area (calculated from information in Cleary *et al.* 2010). Available water is also found in Quaternary, Upper and Lower Cretaceous, and Jurassic age aquifers. Fisk (1967) estimated that the amount of moderately good-quality groundwater within the Great Divide Structural Basin was 500 million ac-ft and 300 million ac-ft within the Washakie Structural Basin. The combined annual recharge for the Great Divide and Washakie structural basins has been estimated at 11,300 ac-ft (Fisk 1967), which is well above the estimated annual 2,700 ac-ft. of water removed for development of the six projects. Cumulative groundwater impacts are not expected to be significant.

5.4.3 Cumulative Impacts within the Watershed Area

Surface Water. The types of cumulative surface-water impacts would be the same as those discussed in **Section 5.4.1**. Surface water impacts would be considered significant for at least one surface-water significance criteria through cumulative impacts if the Proposed Action or any of the action alternatives were selected. Surface water impacts would not be considered significant for Alternative E.

There are two existing large-scale coal mines (Black Butte and Jim Bridger) located within the watershed analysis area. Impacts to surface water from mining activities include increases in runoff, turbidity, and sedimentation within the project area due to disturbances to vegetation and soil resources. Permit requirements and compliance with rules and regulations associated with surface mining are under the jurisdiction of the WDEQ with Office of Surface Mining Reclamation and Enforcement (OSM) oversight. These mines are not expected to contribute measurably to the significance impacts discussed in **Section 4.4.4**.

The existing Sweetwater uranium mill (currently not operational) and the proposed Lost Creek/Lost Soldier in situ uranium recovery (ISR) projects are located in the Great Divide Basin, just north of the project area. These projects have the potential to impact surface water during construction/operation through ground disturbance and vegetation removal or if leachate is accidentally discharged into surface

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waters. The Nuclear Regulatory Commission (NRC) oversees uranium source and byproduct material license applications and the WDEQ has authority over permits to mine for uranium operations.

Wind-energy development and industrial development projects are under the jurisdiction of the Wyoming Industrial Siting Council and boards of county commissioners (through Wyoming HEA No. 0064). Wind-energy development projects have the potential to affect surface water during construction. These projects could result in contamination of surface water, increased surface runoff, erosion, and off-site sedimentation that would cause channel instability and degradation of surface-water quality, particularly where the development impacts drainage channels. The proposed Chokecherry/Sierra Madre Wind Energy Project is the nearest wind-energy development project and is located approximately 7 miles east of the project area in Carbon County. The proposed Sweeney Ranch Wind Park is located approximately 18 miles west of the project area in Sweetwater County and the Middlewood Wind Power Project is located approximately 22 miles east of the project area in Carbon County.

Downstream demands for water in the Green River and Little Snake River drainages would continue to influence water management in the Upper Green and White-Yampa basins, respectively. According to the 2010 Green River Management Plan, which provides a 50-year projection of water use in watersheds that include the Upper Green and White-Yampa basins in Wyoming, approximately 680,000 ac-ft/year would be depleted from the Basin from all sources (agriculture, municipal, domestic, industrial, recreational, environmental, and evaporation) under a moderate growth scenario by 2060 (Wyoming Water Development Office 2011). Wyoming's estimated 2060 allocation of the Upper Colorado River water under the Colorado River Compact totals approximately 847,000 ac-ft/year, which would mean that approximately 167,000 (847,000–680,000) ac-ft/year would remain under the Compact allocation (Wyoming Water Development Office 2011). No surface water would be used for any part of the well drilling or construction process so the proposed project would not contribute to surface-water depletion within the Colorado River system.

According to the WDEQ-WQD database, there are currently 23 active coalbed natural-gas (CBNG), oil-and-gas-related, industrial, or coal mining Wyoming Pollutant Discharge Elimination System (WYPDES) discharge permits in the cumulative watershed area (WDEQ-WQD 2011). The Proposed Action does not include plans for any surface discharge of produced water. It is therefore assumed that all water produced would be injected or evaporated and no additional discharge permits would be necessary for the surface disposal of produced water. Permitting for surface discharge of produced water related to federal land or minerals would require a separate NEPA evaluation.

Groundwater. The types of cumulative groundwater impacts would be the same as those discussed in **Section 5.4.1**. Using the available estimates of water use included in the NEPA analyses of oil and gas projects that are still in development in the watershed analysis area, the total cumulative water demand from oil and gas development would be approximately 46,000 ac-ft over the lives of the projects (BLM 2004, 2005e 2006a, 2007f, 2009b, 2010d, 2011b, and 2011c). This amount is approximately 0.1 percent of the estimated volume of producible groundwater available (75.2 million ac-ft) in Tertiary-age aquifers underlying the Greater Green River Basin (Cleary *et al.* 2010). Available water is also found in Quaternary, Upper and Lower Cretaceous, and Jurassic age aquifers. Fisk (1967) estimated that the amount of moderately good-quality groundwater within the Great Divide Structural Basin was 500 million ac-ft and 300 million ac-ft within the Washakie Structural Basin. The combined annual recharge for the Great Divide and Washakie structural basins has been estimated at 11,300 ac-ft (Fisk 1967), which is much greater than the estimated annual demand of 3,000 ac-ft removed for development.

The Black Butte and Jim Bridger coal mines are located within the watershed analysis area. Impacts of mining, including cumulative hydrologic impacts, are regulated by WDEQ/LQD with oversight by OSM. The mine pits/active workings would be completely dewatered, which would result in drawdown of formation aquifers in the vicinity of the mining activities. These mines are not expected to contribute measurably to contribute measurably to the significance impacts discussed in **Section 4.4.4** since the

extent of drawdown would be limited due to the lack of lateral continuity of the water-bearing units in the affected formation.

The Sweetwater Mill project has the potential to impact groundwater through accidental discharge from the existing tailings impoundment; the impoundment is reported to have leaked several times between 1980 and 1984. Contamination did not leave the site but did enter the upper aquifer. Subsequent remedial actions are reducing the extent of contaminated groundwater. Contaminated soil is being excavated and placed into the existing tailings impoundment and contaminated groundwater is being extracted and placed into the existing tailings impoundment (NRC 2011). The proposed Lost Creek/Lost Soldier project will impact groundwater during recovery and injection well construction and completion or from spills and leaks, excursions, wellfield development drilling, or deep well injection. The NRC oversees uranium source and byproduct material license applications and the WDEQ has authority over permits to mine for uranium operations.

5.5 AIR QUALITY

The CAMx model was used to quantify the impacts to regional air quality and AQRVs resulting from the CD-C project, other proposed oil and gas developments in the study area (Reasonably Foreseeable Development, or RFD) and all other regional emissions sources within the study area. Since the CAMx photochemical grid model was used in the far-field air quality analysis, the impacts of emissions sources outside the Southwest Wyoming study area were also included via transport of these emissions and their chemical reaction products into the study area.

CAMx was used to assess the impacts to both ambient air concentrations and AQRVs from air pollutant emissions of CO, NO_x, SO₂, PM₁₀, PM_{2.5}, and VOC expected to result from CD-C Project emissions combined with regional emissions throughout the study area. The cumulative study considers 2008 as a baseline year for emissions and assesses impacts to air quality at peak project year emissions levels that are expected to occur in year 2022. Air quality impacts are assessed for year 2022, and AQRV impacts are assessed for 2022 and relative to year 2008 levels. The CAMx model was run with both 2008 and 2022 emissions (including the CD-C project area emissions) for two years (2005 and 2006) of meteorological data.

The cumulative assessment was performed using the Proposed Action emissions. The cumulative impacts resulting from all project development alternatives (Alternatives A through D) would be similar to impacts of the Proposed Action. Under Alternative E (No Action) there would be no cumulative impact to air quality or AQRVs since there would be no new development associated with the CD-C project.

5.5.1 Emissions from Regional Sources

Maximum emissions from all RFD sources within the study area were estimated. RFD is defined as (1) air emissions from the undeveloped portions of authorized NEPA projects, and (2) air emissions from not-yet-authorized NEPA projects (if emissions are quantified when modeling commences). RFD information from not-yet-authorized projects was obtained from the BLM and was based on ongoing air quality analyses for NEPA projects.

Full development of proposed projects inventoried as RFD may or may not coincide with full development of the CD-C project. As a result, the assumption that all RFD are fully developed during the maximum year of CD-C project development results in some conservatism in the cumulative impact analysis. A listing of RFD projects which were included in this study, as defined in the paragraph above, is presented in **Table 5.5-1**.

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Table 5.5-1. RFD emissions within the study area.

Project	Modeled Pollutant Emissions (tpy)					
	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}
Moxa Arch Existing Project	1,519	16,444	1,152	1	212	75
Moxa Arch Preferred Alternative	1,257	2,099	2,002	0	582	131
Moxa Arch ROD Wells	63	166	123	0	30	6
Beaver Creek	68	228	60	1	102	11
Eagle Prospect	409	196	395	5	97	29
Gun Barrel-Madden Deep-Iron Horse	850	3,700	2,085	1	1291	160
Pinedale	1,381	2,286	1,250	53	79	79
Hiawatha Proposed Action	2,157	15,904	915	85	3,398	398
Jonah	1,099	2,705	686	62	28	28

Tables 5.5-2 and 5.5-3 summarize the complete regional emission inventories for the study area (the 4-km modeling domain shown in **Map 4.5-1**). The tables report the modeled emissions of CO, NO_x, SO₂, PM₁₀, and PM_{2.5}, and total organic gas (TOG), for each region and emissions source category. The CD-C project emissions that are included in these tables are for the Proposed Action. Emissions tables are presented for 2008, 2022 and the difference between the 2022 future year and 2008 baseline inventories (2022–2008). For each year and for the 2022–2008 difference, emissions are reported for the 2006 meteorological year. (Emissions for both the 2005 and 2006 scenarios are reported in Section 2 of the AQTSD.)

Tables 5.5-2 and 5.5-3 contain emissions for all portions of Wyoming, Colorado, Utah, and Idaho that are within the 4-km modeling domain that comprised the study area. The five counties in Southwest Wyoming covered by the detailed oil and gas emission inventory (described in Section 2 of the AQTSD) are broken out separately from the rest of Wyoming in all of the tables. Oil and gas emissions are broken down into drilling, compressor engine, and production emissions. In **Table 5.5-3**, there are zero entries for the 2022–2008 change in biogenic or fire emissions because the 2006 actual emissions were used in both 2008 and 2022 emission scenarios. The only trona facilities in the study area are located in Wyoming; therefore, trona emissions for Colorado, Idaho, and Utah are zero.

Table 5.5-3 shows that on-road mobile emissions would decrease for all pollutants in all areas between 2008 and 2022 due to increasingly stringent emissions controls. Non-road emissions also decline for all areas for all pollutants except CO. This would occur because of the implementation of non-road engine tier standards that require increasingly cleaner-burning engines as fleet turnover occurs. Non-oil and gas area source emissions would increase for all pollutants within Wyoming going from 2008 to 2022. NO_x and total organic gas (TOG) emissions increase for non-oil and gas area source emissions for all four states in 2022 relative to 2008. This is reasonable because future area source emissions are often projected using population changes as a basis for calculating changes in emissions. 2008 to 2022 changes in electricity generating units (EGU) emissions and non-EGU (NEGU) point source emissions vary by state and pollutant.

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Table 5.5-2. Regional emissions summary table for the 2022 future year (tpy)

STATE	Source Category						
	Oil and Gas	Area	Onroad	Offroad	EGU	NEGU	Natural
CO							
Colorado	799	2,519	15,246	8,426	1,735	67	12,535
Idaho	411	535	2,070	4,583	0	17,670	20,513
Utah	41,451	1,960	16,338	11,877	1,469	109	8,608
Wyoming	27,624	14,596	56,568	37,856	3,816	14,182	82,627
Carbon Co, Wyoming	829	856	56,568	3,713	135	1,552	3,131
Lincoln Co, Wyoming	711	2,129		2,270	819	380	297
Sublette Co, Woming	1,885	716		2,828	0	389	16,203
Sweetwater Co, Wyoming	2,731	1,801		4,670	2,498	11,418	4,076
Uinta Co, Wyoming	534	1,307		2,877	330	99	803
Wyoming (rest)	1,797	7,789		21,498	33	345	58,117
RFD	8,665	0	0	0	0	0	0
CD-C Project	10,474	0	0	0	0	0	0
NO_x							
Colorado	1,291	177	776	849	24,166	89	677
Idaho	152	402	128	478	0	2,378	864
Utah	13,706	244	857	1,272	8,386	112	347
Wyoming	30,556	8,261	3,590	15,066	39,072	12,748	2,911
Carbon Co, Wyoming	2,297	620	3,590	3,149	153	478	111
Lincoln Co, Wyoming	1,820	1,187		1,278	10,880	1,662	16
Sublette Co, Woming	2,476	130		330	0	469	574
Sweetwater Co, Wyoming	4,748	1,478		5,444	27,338	9,601	207
Uinta Co, Wyoming	733	447		1,691	667	120	26
Wyoming (rest)	2,962	4,398		3,173	34	419	1,977
RFD	8,805	0	0	0	0	0	0
CD-C Project	6,717	0	0	0	0	0	0
SO₂							
Colorado	15	83	10	3	7,002	5	16
Idaho	0	15	2	1	0	3,921	97
Utah	731	142	11	3	1,645	10	48
Wyoming	5,602	7,458	45	19	22,374	23,588	556
Carbon Co, Wyoming	60	394	45	3	246	3,354	8
Lincoln Co, Wyoming	1,543	1,838		1	6,357	65	1
Sublette Co, Woming	4	63		1	0	240	117
Sweetwater Co, Wyoming	267	590		5	15,771	14,592	2
Uinta Co, Wyoming	98	237		2	0	876	7
Wyoming (rest)	3,419	4,337		7	0	4,461	422
RFD	208	0	0	0	0	0	0
CD-C Project	4	0	0	0	0	0	0

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Table 5.5-2. Regional emissions summary table for the 2022 future year (tpy), *continued*

STATE	Source Category						
	Oil and Gas	Area	Onroad	Offroad	EGU	NEGU	Natural
TOG							
Colorado	20,767	1,850	830	1,147	183	323	54,199
Idaho	44	5,214	120	1,174	0	7	32,486
Utah	1,060,778	2,668	861	2,300	114	1,673	13,407
Wyoming	1,473,030	22,192	3,257	4,261	683	25,291	89,977
Carbon Co, Wyoming	27,263	22,192	3,257	4,261	12,495	25,291	7,497
Lincoln Co, Wyoming	75,250						878
Sublette Co, Woming	159,573						19,459
Sweetwater Co, Wyoming	313,200						14,911
Uinta Co, Wyoming	8,310						113
Wyoming (rest)	209,909						47,120
RFD	379,714	0	0	0	0	0	0
CD-C Project	299,812	0	0	0	0	0	0
PM₁₀							
Colorado	37	10,544	37	75	592	3,504	261
Idaho	0	9,454	6	62	0	0	1,513
Utah	469	7,134	41	112	887	267	756
Wyoming	8,929	73,379	164	610	3,399	13,320	9,139
Carbon Co, Wyoming	91	8,616	164	118	3	683	131
Lincoln Co, Wyoming	72	3,323		53	1,457	440	16
Sublette Co, Woming	22	5,276		30	0	0	1,915
Sweetwater Co, Wyoming	80	11,445		184	1,939	12,086	30
Uinta Co, Wyoming	3	1,461		62	0	1	110
Wyoming (rest)	90	43,256		163	0	111	6,936
RFD	5,818	0	0	0	0	0	0
CD-C Project	2,753	0	0	0	0	0	0
PM_{2.5}							
Colorado	37	1,191	18	70	0	0	233
Idaho	0	206	3	58	0	0	1,311
Utah	460	772	21	106	561	169	675
Wyoming	1,951	6,410	83	611	4,114	1,776	8,377
Carbon Co, Wyoming	91	940	83	118	0	111	118
Lincoln Co, Wyoming	72	560		53	821	2	15
Sublette Co, Woming	22	532		30	0	0	1,768
Sweetwater Co, Wyoming	80	1,313		184	3,295	1,658	24
Uinta Co, Wyoming	3	298		62	0	0	101
Wyoming (rest)	90	2,768		164	0	6	6,351
RFD	916	0	0	0	0	0	0
CD-C Project	677	0	0	0	0	0	0

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Table 5.5-3. Regional 2022-2008 emissions difference summary table (tpy)

STATE	Source Category						
	Oil and Gas	Area	Onroad	Offroad	EGU	NEGU	Natural
CO							
Colorado	-230	71	-3,116	495	379	9	0
Idaho	149	48	-510	38	0	6,760	0
Utah	23,068	-14	-3,260	-335	1,043	-535	0
Wyoming	15,311	754	-16,099	1,512	478	-3,191	0
Carbon Co, Wyoming	-343	-1	-16,099	-136	135	902	0
Lincoln Co, Wyoming	-434	3		-263	241	52	0
Sublette Co, Woming	-2,543	-8		-572	-20	305	0
Sweetwater Co, Wyoming	-447	6		223	-227	-3,375	0
Uinta Co, Wyoming	-57	-6		-127	330	-4	0
Wyoming (rest)	-5	759		2,387	19	-1,070	0
RFD	8,665	0	0	0	0	0	0
CD-C Project	10,474	0	0	0	0	0	0
NO_x							
Colorado	-422	25	-959	-396	-4,523	4	0
Idaho	-1,129	63	-173	-197	0	445	0
Utah	2,216	30	-1,067	-499	1,177	-1,017	0
Wyoming	8,921	1,126	-4,999	-4,028	544	-2,065	0
Carbon Co, Wyoming	-319	55	-4,999	-950	153	-144	0
Lincoln Co, Wyoming	-449	147		-453	-3,614	247	0
Sublette Co, Woming	-5,134	9		-177	-204	365	0
Sweetwater Co, Wyoming	-632	125		-1,551	3,535	-1,584	0
Uinta Co, Wyoming	-60	38		-564	667	74	0
Wyoming (rest)	-7	752		-334	7	-1,022	0
RFD	8,805	0	0	0	0	0	0
CD-C Project	6,717	0	0	0	0	0	0
SO₂							
Colorado	-5	3	-1	-30	-792	1	0
Idaho	-1	1	0	-17	0	-4,997	0
Utah	550	-2	-1	-42	672	4	0
Wyoming	100	1,039	-7	-387	-21,604	8,017	0
Carbon Co, Wyoming	0	62	-7	-82	246	2,252	0
Lincoln Co, Wyoming	-4	343		-36	-16,413	-129	0
Sublette Co, Woming	-132	2		-13	0	224	0
Sweetwater Co, Wyoming	-1	29		-135	-5,436	2,195	0
Uinta Co, Wyoming	0	8		-46	0	862	0
Wyoming (rest)	26	595		-75	-1	2,613	0
RFD	208	0	0	0	0	0	0
CD-C Project	4	0	0	0	0	0	0
TOG							
Colorado	-56,252	241	-574	-555	46	56	0
Idaho	-504	1,320	-88	-284	0	-3	0
Utah	650,722	653	-574	-1,233	49	-384	0
Wyoming	345,625	3,629	-2,539	-1,555	-396	2,555	0
Carbon Co, Wyoming	-131,161	3,629	-2,539	-1,555	11,417	2,555	0
Lincoln Co, Wyoming	-93,086						6
Sublette Co, Woming	-24,304						696
Sweetwater Co, Wyoming	-48,612						11

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Table 5.5-3. Regional 2022-2008 emissions difference summary table (tpy), *continued*

STATE	Source Category						
	Oil and Gas	Area	Onroad	Offroad	EGU	NEGU	Natural
TOG							
Uinta Co, Wyoming	-34,022						40
Wyoming (rest)	-2,716						2,510
RFD	379,714	0	0	0	0	0	0
CD-C Project	299,812	0	0	0	0	0	0
PM₁₀							
Colorado	-25	2,048	-11	-60	182	-348	0
Idaho	0	394	-3	-34	0	-468	0
Utah	26	1,043	-14	-90	316	42	0
Wyoming	8,406	24,037	-77	-369	-6,199	-1,419	0
Carbon Co, Wyoming	-10	240	-77	-74	3	415	0
Lincoln Co, Wyoming	-8	426		-43	-5,085	-908	0
Sublette Co, Woming	-130	928		-34	-3	-34	0
Sweetwater Co, Wyoming	-9	-1,239		-93	-1,107	-350	0
Uinta Co, Wyoming	-1	-78		-43	0	-53	0
Wyoming (rest)	-9	23,761		-81	-7	-489	0
RFD	5,818	0	0	0	0	0	0
CD-C Project	2,753	0	0	0	0	0	0
PM_{2.5}							
Colorado	-24	-11	-13	-58	0	0	0
Idaho	0	22	-3	-33	0	-376	0
Utah	25	-64	-16	-86	90	24	0
Wyoming	1,428	-311	-79	-328	-5,484	-902	0
Carbon Co, Wyoming	-10	-18	-79	-67	0	107	0
Lincoln Co, Wyoming	-8	11		-40	-5,720	-297	0
Sublette Co, Woming	-130	-2		-31	-3	-22	0
Sweetwater Co, Wyoming	-9	-180		-84	248	-528	0
Uinta Co, Wyoming	-1	-18		-40	0	-1	0
Wyoming (rest)	-9	-103		-68	-7	-162	0
RFD	916	0	0	0	0	0	0
CD-C Project	677	0	0	0	0	0	0

5.5.2 Criteria Pollutants Impacts

The results of the cumulative modeling showed that there would be no exceedances of the NAAQS, WAAQS, or CAAQS for ozone or any other criteria pollutant within the study area, except in the immediate vicinity of sources unrelated to the CD-C project. There would be predicted exceedances of the CO (8-hour), PM₁₀/PM_{2.5} (24-hour), ozone, and SO₂ (1-hour) standards within the study area; however, the CD-C project emissions would not make a significant contribution to these values. In addition, PSD increments would not be exceeded at any Class I or sensitive Class II area within the study area. Additional detail on the modeling results are provided in Section 4 of the AQTSD.

Mid-Field Impacts

CAMx-estimated criteria pollutant impacts from the CD-C project and regional sources, within and near the CD-C project area and these are shown in **Table 5.5-4**. As indicated in Table 5.5-4, the cumulative impacts resulting from project and regional sources would be below the WAAQS and NAAQS.

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Table 5.5-4. CD-C project and regional sources: mid-field criteria pollutant modeling results

Pollutant	Averaging Time	Modeled Concentration from All Sources ($\mu\text{g}/\text{m}^3$)	WAAQS ($\mu\text{g}/\text{m}^3$)	NAAQS ($\mu\text{g}/\text{m}^3$)
CO	1-hour	491.3	40,000	40,000
	8-hour	357.0	10,000	10,000
NO ₂	1-hour	81.4 ¹	n/a	188
	Annual	17.1	100	100
O ₃	8-hour	142.4	147	147
SO ₂	1-hour	30.8 ²	n/a	196
	3-hour	30.0	1,300	1,300
	24-hour	11.3	260	365
	Annual	3.1	60	80
PM ₁₀	24-hour	55.8	150	n/a
	Annual	7.5	50	50
PM _{2.5}	24-hour	18.7	n/a	35
	Annual	3.8	n/a	15

¹ NO₂ 1-hour concentration is 8th highest daily maximum 1-hour concentration. Value includes contribution from NO.

² SO₂ 1-hour concentration is 4th highest daily maximum 1-hour concentration.

5.3.3 Visibility Impacts

In the cumulative analysis, changes in light extinction from CD-C project sources combined with all cumulative emissions sources were calculated for each day at Class I and sensitive Class II areas within the study area (**Map 4.5-1**). The daily average differences in modeled concentrations between the 2022 future and 2008 baseline years were calculated for each Class I/II area, and these concentration differences were used to estimate visibility impairment following FLAG 2010 guidance. The maximum and number of days greater than the 0.5 and 1.0 Δdv thresholds are disclosed. Two additional methods for evaluating cumulative visibility impacts were explored and a discussion of these methods and the results obtained from applying them are presented in Section 4.6.1 of the AQTSD.

Cumulative visibility impacts at Class I and sensitive Class II areas estimated using the FLAG 2010 method are shown in **Table 5.5-5**. The largest impacts would occur at Dinosaur National Monument, which would have the greatest number of days that exceed 0.5 Δdv and 1.0 Δdv thresholds. All Class I/II areas within the study area would have days in which the 2022–2008 concentration differences produce changes in extinction greater than 0.5 Δdv . The Mount Zirkel, Rawah, and Savage Run Wilderness areas would not have any days with impacts above 1.0 Δdv , but all other Class I/II areas would have days that exceed 1.0 Δdv . Using the 98th percentile value as a threshold, impacts at the Popo Agie Wilderness area are at the 0.5 Δdv threshold, and impacts at the Bridger, and Fitzpatrick Wilderness areas, the Wind River Roadless area, and Dinosaur National Monument would be above the 0.5 Δdv threshold, and the 1.0 Δdv threshold would be exceeded at only Dinosaur National Monument.

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Table 5.5-5. Cumulative visibility results

Class I or Sensitive Class II Area	Number of Days > 0.5 Δ dv	Number of Days > 1.0 Δ dv	Maximum Δ dv	98 th Percentile Maximum Δ dv
Bridger Wilderness Area	9	1	1.30	0.52
Fitzpatrick Wilderness Area	8	3	1.71	0.62
Savage Run Wilderness Area	4	0	0.76	0.40
Mount Zirkel Wilderness Area	5	0	0.77	0.43
Rawah Wilderness Area	5	0	0.78	0.38
Popo Agie Wilderness Area	7	3	1.73	0.50
Wind River Roadless Area	9	3	1.55	0.55
Dinosaur National Monument	30	12	2.11	1.29

5.3.4 Atmospheric Deposition Impacts

Modeled wet and dry fluxes of sulfur- and nitrogen-containing species due to emissions from the CD-C project and all other cumulative regional sources were processed to estimate total annual sulfur (S) and nitrogen (N) deposition values at each PSD Class I and sensitive PSD Class II area. Maximum predicted S and N deposition impacts were estimated for existing emissions sources within the CD-C project area taken together with the cumulative effects of all sources in the region.

Table 5.5-6 shows maximum predicted total nitrogen and sulfur deposition impacts from all emission sources for the year 2022. Estimated cumulative nitrogen deposition impacts at all Class I and sensitive Class II areas within the study area would be above the critical load threshold of 1.5 kg/ha/yr. Estimated sulfur deposition impacts would be below the 3.0 kg/ha/yr threshold at all areas except for the Mount Zirkel Wilderness area and Dinosaur National Monument. Cumulative nitrogen deposition impacts can be addressed by a number of mitigation or development strategies designed to minimize NO_x emissions from the project. These mitigation strategies are further described in **Section 4.5.6, Unavoidable Adverse Impacts and Additional Mitigation Measures**. Deposition impacts are summarized in detail in Section 4.6.2 of the AQTSD.

Table 5.5-6. Cumulative nitrogen and sulfur deposition impacts

Class I or Sensitive Class II Area	Nitrogen (kg/ha)	Sulfur (kg/ha)
Bridger Wilderness Area	2.76	2.88
Fitzpatrick Wilderness Area	2.36	3.25
Savage Run Wilderness Area	2.48	2.68
Mount Zirkel Wilderness Area	4.17	5.43
Rawah Wilderness Area	3.14	4.47
Popo Agie Wilderness Area	2.56	3.66
Wind River Roadless Area	2.26	3.60
Dinosaur National Monument	4.51	6.02

Table 5.5-7 shows the 2022–2008 change in maximum nitrogen and sulfur deposition at all Class I/II areas. The modeling results indicate that cumulative nitrogen and sulfur deposition impacts in 2022 would decrease in all Class I/II areas relative to year 2008.

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Table 5.5-7. 2022-2008 Change in cumulative nitrogen and sulfur deposition

Class I or Sensitive Class II Area	Nitrogen Deposition		Sulfur Deposition	
	Deposition (kg/ha)	% Change	Deposition (kg/ha)	% Change
Bridger Wilderness Area	-0.28	-9.0	-0.14	-9.1
Fitzpatrick Wilderness Area	-0.23	-6.6	-0.08	-4.7
Savage Run Wilderness Area	-0.28	-9.4	-0.11	-9.2
Mount Zirkel Wilderness Area	-0.51	-10.1	-0.27	-10.5
Rawah Wilderness Area	-0.40	-10.1	-0.19	-10.0
Popo Agie Wilderness Area	-0.29	-8.1	-0.15	-7.1
Wind River Roadless Area	-0.20	-5.2	-0.11	-5.1
Dinosaur National Monument	-0.36	-7.3	-0.25	-7.8

Acidification at Sensitive Lakes

Modeling results for cumulative sources indicated that there would be no ANC changes at any of the 12 analyzed lakes that exceed the 10-percent threshold or the $\Delta\text{ANC} < 1 \mu\text{eq/L}$ threshold for the two extremely sensitive lakes. Lake ANC impacts are summarized in Section 4.6.3 of the AQTSD.

5.3.5 Climate Change Impacts

As discussed in sections 3.5 and 4.5 **Air Quality**, the current scientific consensus is that anthropogenic emissions of GHGs are causing the climate system to warm, and the impacts of this warming are likely to be larger in the 21st century than in the 20th century if emission trends continue unabated (IPCC, 2007). Forecasts of changes in the climate system under differing GHG emissions scenarios are made with global climate models. Forecasts of regional effects of global change derived from integrations of global models are available but are highly uncertain. In North America, predicted regional impacts of global warming include warming in western mountains, decreased snowpack, and increased frequency and intensity of heat waves (IPCC, 2007).

The GHGs to be emitted by the Proposed Action and the action alternatives, and from other RFD projects in the study area, are CO₂, CH₄, and N₂O, all of which have atmospheric lifetimes on the order of years (IPCC, 2007). Emissions of GHGs from any particular source become well-mixed throughout the global atmosphere. GHG emissions from all sources contribute to the global atmospheric burden of GHGs, and it is not possible to attribute a particular climate impact in any given region to GHG emissions from a particular source. Therefore, no modeled climate change impact predictions from Proposed Action or action alternative GHG emissions sources or cumulative GHG emissions sources in the vicinity of the project area are available.

■ **BIOLOGICAL ENVIRONMENT**

5.6 VEGETATION AND RIPARIAN/WETLAND COMMUNITIES

The CIAA for vegetation communities is the CD-C project area. Historic development in the project area accounts for 60,176 acres of initial disturbance and 17,663 acres of long-term disturbance. Added to this total, the Proposed Action and the action alternatives would disturb between 61,696 acres (Alternative A) and 36,499 acres (Alternative D) in the short term (**Table 2.4-1**). The long-term disturbance would range from 24,133 to 14,953 acres. Due to the long timeframe needed to recover shrub habitat, there would be an increase of acreage dominated by herbaceous vegetation versus that dominated by shrubs throughout the CD-C project area.

Factors impacting vegetation besides removal include the indirect impact of dust accumulation on vegetation, resulting in reduced photosynthetic activity and growth and lower palatability for herbivores. Additionally, the increase in invasive species in the project area has already affected the native vegetation and would continue to do so. Vegetation is also impacted by other existing uses such as livestock grazing, wildlife foraging, and wild horse grazing. These uses will continue into the future and as available vegetation is removed, competition among these species (especially on critical winter range) could further impact the vigor of the vegetation in those areas. Soil loss and compaction in areas of construction can also contribute to the difficulty of reclamation.

Wetlands and riparian communities are a very small component of the vegetation cover in the CD-C area. Protections are in place to protect these areas from physical impact, but those adjacent to gravel or dirt roads could be impacted by dust.

Other actions within and near the CIAA could add to this impact. Roads within the project area are utilized to travel to adjacent projects such as the Atlantic Rim Natural Gas Field to the east and Desolation Flats to the west. Secondary roads may also be used to access the Luman Rim project adjacent to the northwest border of the project area. Additionally, three new transmission lines are proposed to cross the project area which would increase traffic during the planning and development stages. This additional use of the gravel and dirt roads within the project area would contribute additional dust and the vehicles could transport seeds of noxious plant species both into and out of the project area.

5.7 INVASIVE, NON-NATIVE SPECIES

The CIAA for invasive species is the CD-C project area and adjacent areas of development that could provide a seed source for invasive plants and also could provide sites for potential infestation by invasive species from the CD-C project area.

Impacts to vegetation and range resources would occur on all lands in the project area under the Proposed Action and all action alternatives, as well as on private and state lands under the No Action Alternative, due to an increase in surface disturbance which could provide more suitable habitat for invasive weed infestations.

Vehicles and equipment traveling from weed-infested areas, within and outside the project area, could facilitate the spread of invasive weeds into previously weed-free areas in addition to facilitating the spread of seeds of existing invasive populations. Surface-disturbing activities could increase the potential for infestation and spread of invasive plant species. Invasive weed species usually thrive on newly disturbed surfaces and out-compete more desirable native plant species. Creation of new sites for weed infestations may occur in proximity to roads where fugitive-dust deposition on roadside plants reduces their density due to reduced photosynthetic activity and reduced vigor, thus providing a suitable habitat for invasive plants to establish.

In addition to the CD-C project, several other natural gas projects are located adjacent to the project area and could provide potential seed sources for establishment of invasive species in the project area. They include Atlantic Rim on the east of the project area, Desolation Flats on the southwest, and Luman Rim on the northwest. Additionally, three transmission-line projects are proposed to cross the project area and vehicles/equipment associated with the planning and construction of those projects provide other potential seed sources and seed vectors.

5.8 WILDLIFE

The cumulative impact analysis areas (CIAAs) for wildlife resources differ with respect to species. This analysis examines the proportion of the wildlife habitat within respective CIAAs that may be disturbed from all past, present, and RFFAs. The combination of individual projects results in a large area potentially exposed to increased fragmentation, disturbance of wildlife and their habitats, disruption of migratory corridors, and the loss of refuge areas. Additional effects are expected on wildlife dispersal, the reduction of non-fragmented habitats, competition with livestock, and competition with other wildlife species. The generalized increase of human presence and associated disturbance across such a broad scale are a concern. Remaining ranges with increased competition for forage leading to reduced carrying capacity and juvenile survival can also be expected for some species. Mitigations, COAs, and other BMPs would reduce the impacts of these developments, but not eliminate them. Reduced populations and population viability can be expected in high-density development areas.

Cumulative indirect effects from the Proposed Action or alternatives and RFFAs to all wildlife species in general would come from road/traffic impacts, including vehicle collisions, noise, and dust. As roads are developed within and adjacent to the project area, habitat is fragmented. Roads can serve as barriers to some animal movement. The displacement of species away from roadsides can be reasonably predicted. Roads also provide access to the public into areas that were previously undisturbed/undeveloped. Human encroachment in the form of casual backcountry recreation, hunting, and poaching could occur at higher rates resulting in effects such as disturbance during sensitive periods, displacement, or increased mortality.

Insects, birds, and amphibians all avoid dust and noise from roads, which compounds impacts to adjacent habitats throughout the CIAA. Sagebrush-obligate species would be affected by the cumulative removal of habitat (reduction or fragmentation of patch size or vertical habitat structure) and the expanded road system throughout the area.

For raptors, small mammals, and neotropical migratory birds, the impacts anticipated from the Proposed Action, alternatives, and RFFAs would be similar with the exception of Alternative A (100-Percent Vertical Drilling) which would disturb more acreage over the long term. The Proposed Action and the action alternatives provide a variety of mitigations and protections for various wildlife species. Alternative B, with enhanced mitigations and protections, would enhance habitat for prey and grassland species. Alternative D, with required directional drilling on federal mineral estate, would reduce surface disturbance, and associated shrub habitat removal, by about 23 percent when compared to the Proposed Action. Under all Alternatives, with the exception of Alternative E (No Action), sagebrush obligates would experience an overall reduction in suitable habitat for the life of the various projects within the CIAA.

5.8.1 Big Game

Disturbance during construction and production, such as human presence, dust, and noise may displace or preclude big game use during all seasons. Prohibiting construction, drilling, and other activities potentially disruptive to wildlife during sensitive time periods (e.g. winter) would minimize the probability of displacement during these critical times. The extent of displacement would be related to the duration, magnitude, and visual prominence of the activity, as well as the extent of construction and

operational noise levels above existing background levels. Displacement would result in local reductions in wildlife populations if adjacent, undisturbed habitats are at carrying capacity. In this situation animals are either forced into less-optimal habitats or they compete with other animals that already occupy unaffected habitats. Possible consequences of such displacement are lower survival, lower reproductive success, lower recruitment, and ultimately lower carrying capacity and reduced populations (WGFD 2010). Refer to **Section 4.8.3** for a more in-depth discussion of possible direct and indirect impacts of the CD-C project or other CIAA projects to big game.

Construction, such as building well pads and roads, reduces forage available to big game. The significance of this forage reduction is greater in big game CWR, especially as development cumulatively and concurrently occurs outside the project area in adjacent oil and gas development areas. The application of seasonal restrictions intended to minimize CWR disturbance could serve to further concentrate big game in those refuge areas. These seasonal restrictions are not generally applied in state and fee energy development areas. In addition, new gas field-related roads provide unconstrained access to the general public which could result in increased human presence during sensitive periods such as winter. Recreational “antler hunting” has been identified by WGFD as an issue in CWR in some areas of the state.

Big game populations are managed within Herd Units designated for each species and cumulative impacts are discussed in the context of these areas. Implementation of the proposed project would affect crucial winter/winter yearlong range for these big game species. Elk are not considered in this cumulative impact analysis as CWR for the species would not be impacted by the CD-C project. The specific locations of future disturbances within the CD-C project area and the other RFFAs (**Section 5.0**) that fall within the Herd Units and crucial seasonal habitats are unknown; therefore, the exact location of each seasonal big game range or migration route that may be affected by development activity is unknown. The cumulative portion of each CD-C big game CWR that could be affected by the combination of existing, proposed, and RFFA disturbances for pronghorn and mule deer is discussed below. Cumulative impacts to big game would include permanent, short-term, and long-term loss of habitat, as well as increased stress due to human/wildlife encounters, potential reductions in birth/survival rates, and possible alterations of migration routes.

Pronghorn. The cumulative impact analysis area for pronghorn comprises the Herd Units impacted by the CD-C project (**Map 5.8-1**). Cumulative impacts to pronghorn migration routes are unknown at this time; however, the current fencing along WY 789 creates a barrier to pronghorn attempting to migrate across this highway. The WGFD has constructed highway underpasses along WY 789 in an effort to provide safe access during migration and reduce the frequency of vehicle collision; however, pronghorn do not appear to use these accommodations (WYDOT 2012, J. Gregson pers. com. January 2012). I-80 constitutes a significant barrier to pronghorn seasonal movements. Dependent on the severity of the winter, there are miles of rangeland fence that also create migration barriers for pronghorn.

It is assumed that most, if not all, of the Baggs herd transition range is located within the interface of the CD-C and Atlantic Rim project areas (BLM 2007) along WY 789. Approximately 76 percent of the Baggs Herd Unit crucial winter/yearlong range could be affected by long-term development in the following areas: 30 percent within the CD-C project area, 42.6 percent within the Atlantic Rim project area, and 3.4 percent within new transmission line corridors. Virtually all of the Baggs pronghorn crucial winter range lies within one or more oil and gas project boundary.

Approximately 44.5 percent of the Bitter Creek Herd Unit CWR is located within the project area for the Proposed Action and other RFFAs including Hiawatha (22.7 percent), CD-C (10 percent), Desolation Flats (6.5 percent), and new transmission line corridors (3 percent), as well as other existing oil and gas development actions. The CD-C project and new transmission line corridors could affect approximately 19 percent of the Red Desert Herd Unit CWR. It is anticipated that the CWR in the Red Desert Herd Unit would also be affected by scattered oil and gas development activities.

Legend:

- Reasonably Foreseeable Future Action
- Proposed Transmission Lines
 - Gateway West
 - Gateway South
 - Transwest Express
- Pronghorn Seasonal Range
 - Crucial Winter/Yearlong
 - Pronghorn Herd Unit
 - 414- Bitter Creek
 - 438- Baggs
 - 615- Red Desert
- CD-C Project Area

Map Labels: Carbon, Natrona, Fremont, Sublette, Colorado, Routt, Moffat, Sweetwater, White Mountain Wind, Quaking Aspen Wind, Sweeney Ranch Wind, Black Butte Coal Mine, Jim Bridger Coal Mine, Luman Rim Natural Gas, Lost Creek Uranium Mine, Table Rock Natural Gas, Desolation Flats Natural Gas, Bitter Creek II Natural Gas, Hawatha Natural Gas, South Baggs Natural Gas, Atlantic Rim Natural Gas, Sierra Madre Wind, Clokecherry Wind, Dad, Creston Junction, Wamsutter, Tipton, Rock Springs, Baggs, Rawlins.

Scale: 0 to 20 Miles. NAD 1983 UTM Zone 13N.

Map 5.8-1. Cumulative impact analysis area, pronghorn

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Mule deer. The cumulative impact analysis area for mule deer comprises the Herd Units impacted by the CD-C project (**Map 5.8-2**). Cumulative impacts upon mule deer migration routes within the Baggs Herd Unit are unknown; however, WGFD and the Wyoming Department of Transportation have constructed highway underpasses along WY 789 in an effort to provide safe access during migration and reduce the frequency of vehicle collision. Mule deer are successfully using these underpasses (WYDOT 2012, J. Gregson pers. com. January 2012).

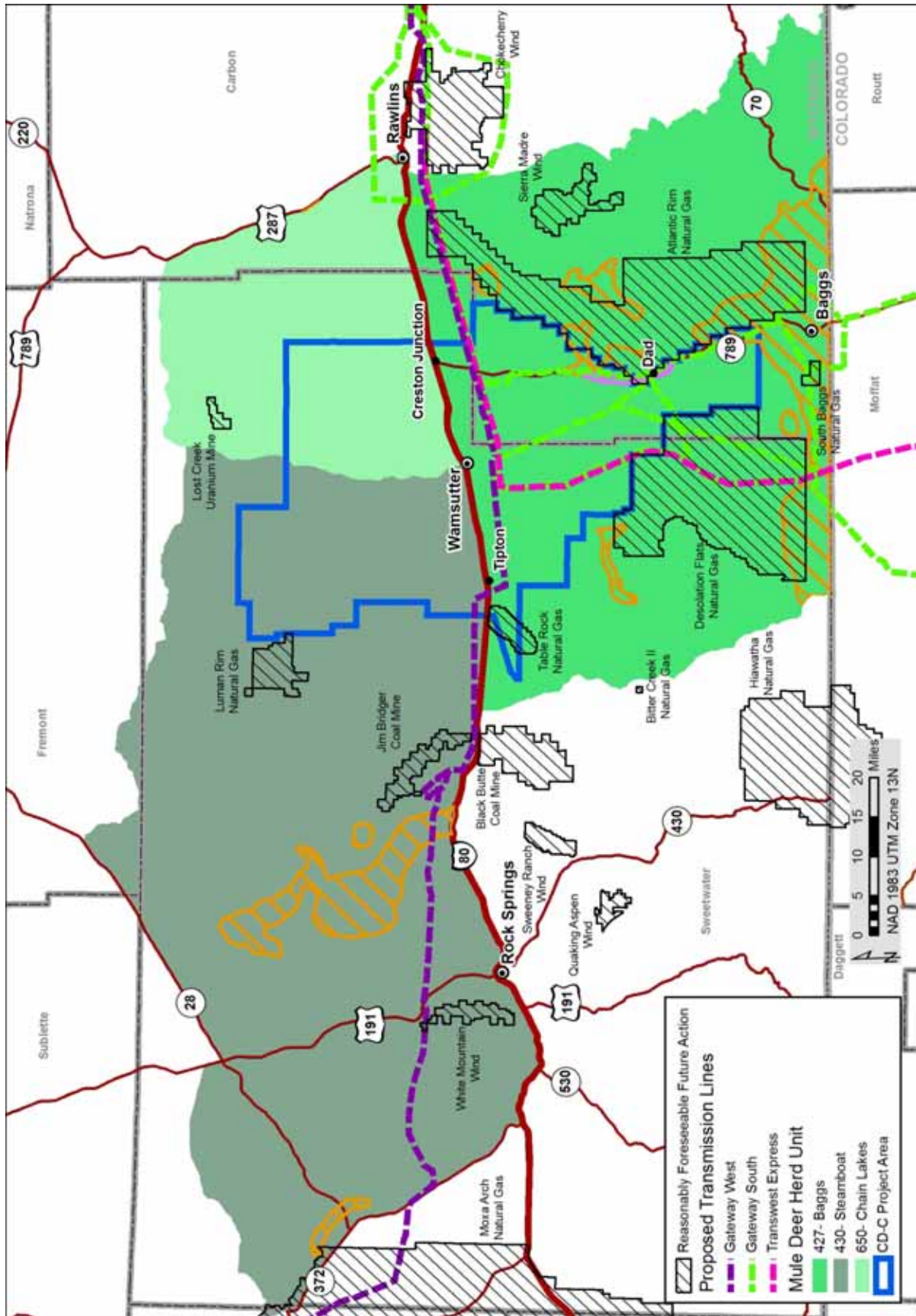
As with pronghorn, it is assumed that most, if not all, of this herd's transition range is located within the interface of CD-C and Atlantic Rim project areas (BLM 2007) along WY 789. Approximately 6 percent of the Baggs Herd Unit crucial winter/year-long range could be affected by long-term development within the CD-C project area, another 26 percent falls within the Atlantic Rim project area, 7 percent would be affected by the Desolation Flats project, and approximately 4 percent is located within 0.5 mile of proposed new transmission-line corridors. Over 44 percent of the Baggs mule deer CWR may lie within one or more reasonably foreseeable oil and gas project or transmission line corridors. As discussed in **Section 4.8.3.1**, predictive maps suggest some habitats considered "high probability of use" areas prior to development would change to "low probability of use" areas as development progresses. These impacts would be increased as the CD-C, Atlantic Rim, and Desolation Flats projects are developed. Approximately 31 acres of mule deer CWR are identified in the Chain Lakes Herd Unit, none of which would be affected by the CD-C project or other RFFAs. None of the CWR in the Steamboat Herd Unit would be affected by the CD-C project; approximately 2 percent could be influenced by new transmission line corridors.

Elk. The cumulative impact analysis area for elk comprises the Herd Units impacted by the CD-C project. No elk CWR or migrations routes have been identified in the CD-C project area.

Overlapping big game crucial winter ranges are located at the interface of the CD-C project area and the Atlantic Rim project area along WY 789 (**Map 3.8-7**). As discussed above, this area is expected to see additional development and production activity resulting in additional stress and displacement of pronghorn and mule deer, as well as reduced winter forage as a result of increased surface disturbance. Impacts to these herds would be exacerbated by the current fair to poor condition of forage in crucial winter habitat designated areas (see **Section 4.8.3.1**). Over the long term, the impacts anticipated from the CD-C project and RFFAs would be similar for the various CD-C project area development alternatives with the exception of Alternative A (100-Percent Vertical Drilling) which would disturb more acres over the long term, and Alternative D which would reduce total surface disturbance, and associated shrub habitats, by approximately 23 percent, when compared to the Proposed Action. Alternative B (Enhanced Resource Protection) and Alternative C (Surface Disturbance Cap with High and Low Density Development Areas) would both provide protection to big game CWR areas over the life of the project. The ERP provides a variety of impact thresholds, each of which enhances the mitigation and protection for wildlife species and their respective critical seasonal ranges. BLM seasonal restrictions and those enhancement provided under Alternative B are not generally applied in state and fee energy development areas.

An indirect impact of these CIAA actions includes unrestricted access by the general public using gas field-related roads which could result in increased human presence in CWR during sensitive periods. Recreational "antler hunting" has been identified by WGFD as an issue in CWR in some areas of the state.

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Map 5.8-2. Cumulative impact analysis area, mule deer

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5.8.2 Raptors

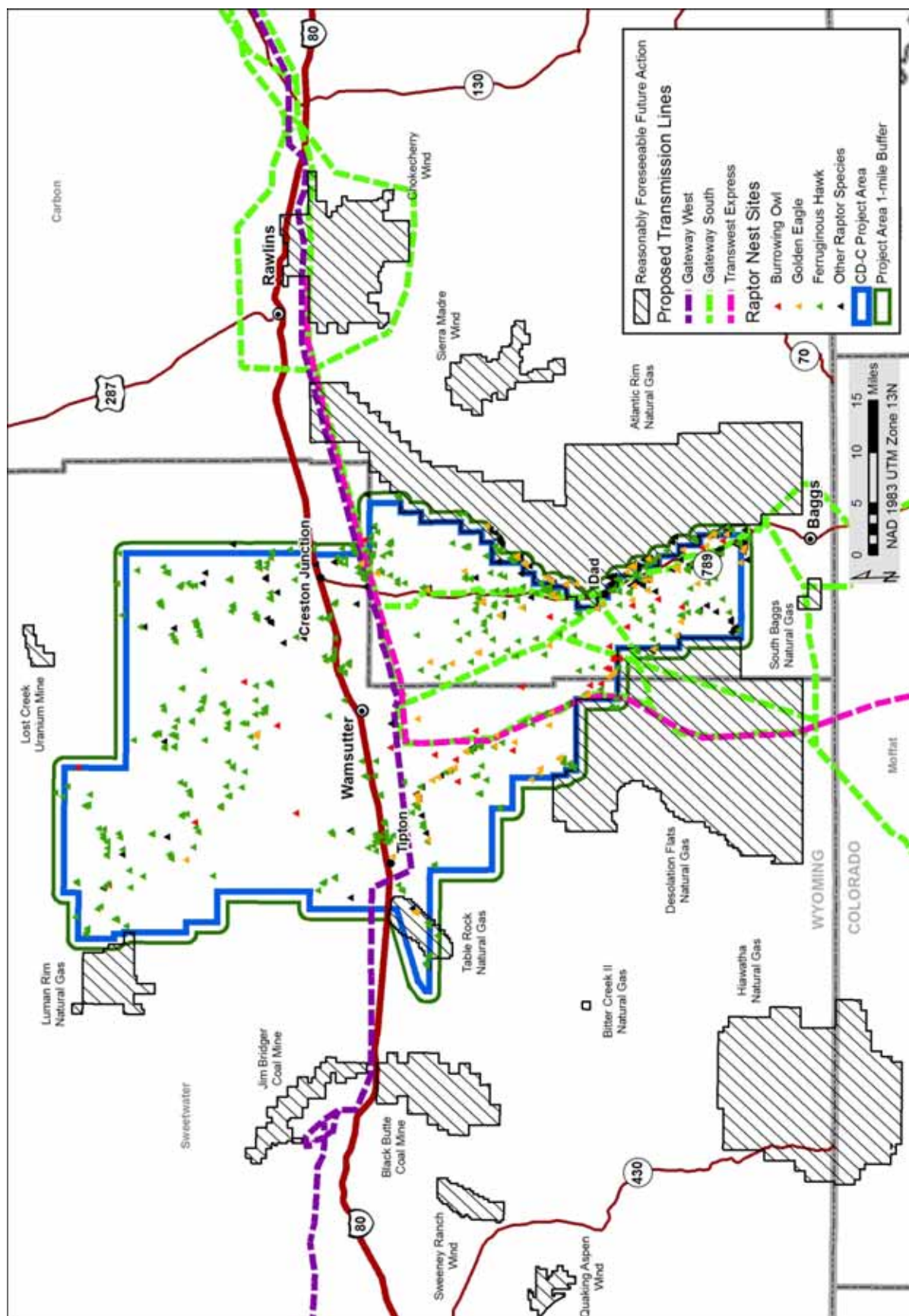
The CIAA for raptors includes the CD-C project area plus a 1-mile buffer (**Map 5.8-3**). This area covers approximately 1,226,825 acres, all of which would be considered raptor foraging habitat. Approximately 939 nests are known to occur in the CIAA; 780 known nests (83 percent) are within the project area, 122 nest sites are located in the CIAA of overlap between Atlantic Rim and CD-C project area, 14 would possibly be affected by transmission lines, and another 14 lie in the overlap area between Desolation Flats and the CD-C project area. Approximately 61 percent of the known nests are ferruginous hawk, 10 percent are golden eagle, and 5 percent are red-tailed hawk; the remaining 25 percent are various species including burrowing owl, prairie falcon, American kestrel, and unknowns. Potentially positive cumulative impacts from the creation of additional nesting sites (i.e., artificial nesting structures including hydrocarbon stock tanks) are known from other conventional oil and gas projects in the vicinity of the CD-C project area.

As with the Proposed Action and the various alternatives analyzed, the required buffers and restrictions on activity around active raptor nests and the fact that most of the prey utilize habitat that can be reclaimed in a timely fashion, the impacts on most raptor species in the CD-C project area and associated RFFA overlap areas is not expected to exceed the significance criteria. However, the BLM timing stipulations for protection of raptor nests is not applied on State and fee energy development actions. Refer to **Section 5.9.3** for a discussion of CIAA on the ferruginous hawk.

5.8.3 Fish

Cumulative impacts to fish species would include the effects of the CD-C project and other developments upstream in Muddy Creek, the most notable of which is the Atlantic Rim Natural Gas Project. At this time there are no known additional proposals to analyze or assess.

About 10 game-fish species and 20 non-game fish species may occur within or upstream/downstream from these two project areas. Of these, about 14 species, including six native species, are likely to be present within the project areas. Of the 14, four are BLM Sensitive Species and 10 are not. All of the 10 species that are not BLM sensitive would be subject to the same types of impacts described in **Section 4.9.3.1. Sensitive Fish Species**; however, they have a wide distribution within Wyoming (Baxter and Stone 1995). Consequently, the project area and other human activities within the Muddy Creek and Great Basin watersheds may have localized population impacts, but these impacts should not impact their status range-wide.



Map 5.8-3. Cumulative impact analysis area, raptors

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5.9 SPECIAL STATUS PLANT, WILDLIFE, AND FISH SPECIES

The CIAAs for wildlife resources differ with respect to species. The combination of the individual projects could result in a large area of increased fragmentation, disturbance of wildlife and their habitats, disruption of migratory corridors, and the loss of refuge areas. Additional effects could be wildlife dispersal, the reduction of non-fragmented habitats, competition with livestock, and inter-specific competition. The generalized increase in human presence and associated disturbance across such a broad scale are a concern. It can also be expected that competition for forage would increase in the remaining habitats leading to reduced carrying capacity and juvenile survival for some species; see **Section 4.9.3** for a more detailed discussion of potential impacts to special status species. Mitigations, COAs, and other BMPs would reduce the impacts of these developments, but not eliminate them. Reduced populations and population viability for some species can be expected in high density development areas. However, the BLM mitigations, COAs, BMPs etc., are not generally applied on state and fee energy development actions.

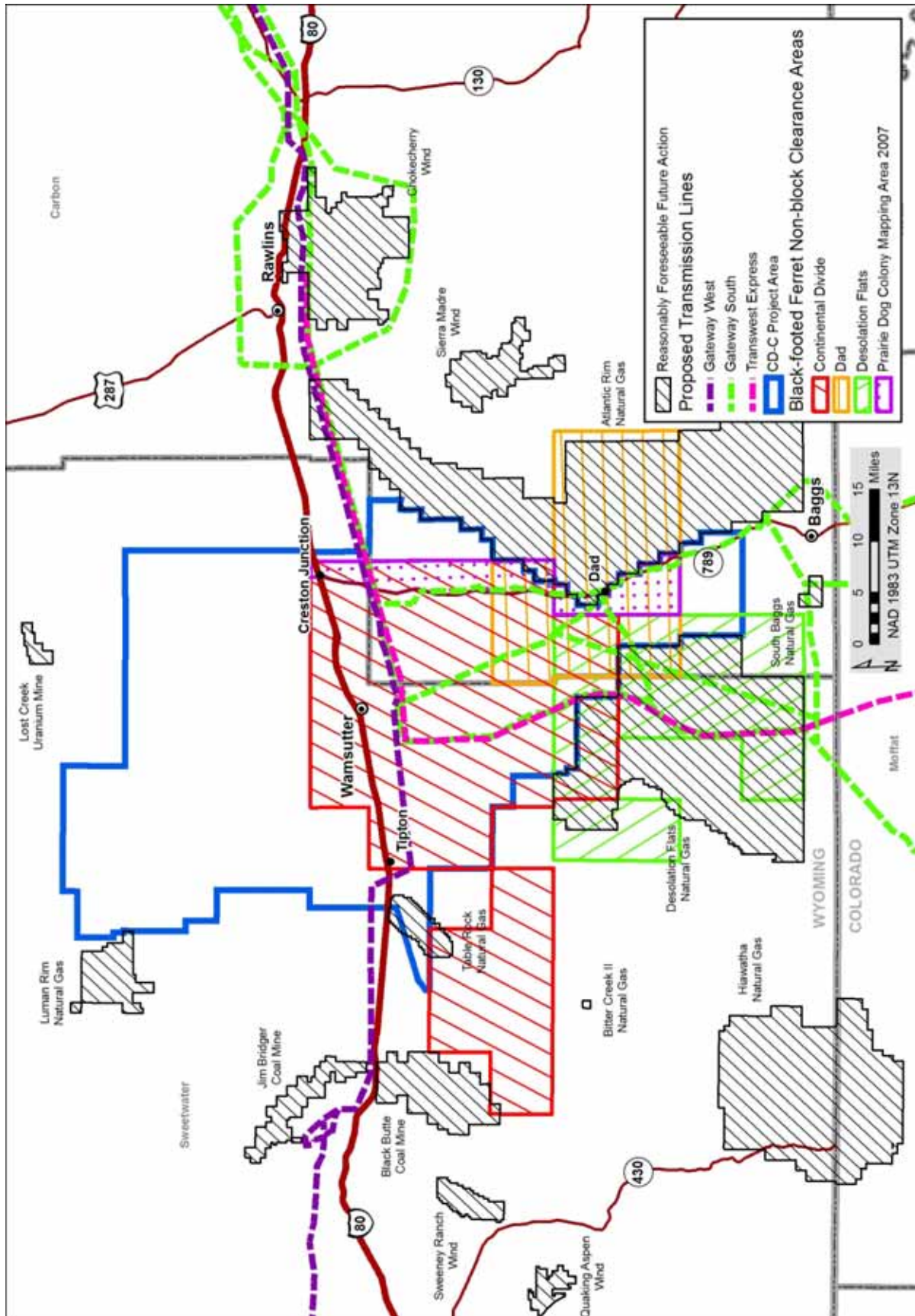
5.9.1 Threatened, Endangered, Proposed or Candidate Wildlife Species

Threatened and Endangered Wildlife Species

Black-footed ferret. The presence of black-footed ferret in the CD-C project area is very unlikely (see **Section 3.9.1.1**). The various CD-C alternatives would likely disturb colonies of white-tailed prairie-dogs, which are the black-footed ferret's primary habitat and prey source in this area. Surveys for black-footed ferrets may be required before ground-disturbing activities within identified prairie-dog complexes located in the Continental Divide, Dad, and Desolation Flats non-block clearance areas for all RFFAs potentially affecting those areas (**Map 5.9-1**). Without pre-disturbance surveys, significant impacts could occur in the non-block cleared areas; for example, almost 95 percent of the Dad and 80 percent of the Desolation Flats non-block clearance areas could be affected by the CD-C project area and other RFFAs. However, of the white-tailed prairie dog complexes identified as potential black-footed ferret habitat (**Map 5.9-1**), it is anticipated that only Complex 1 would be impacted and only by the CD-C project. Complexes 2 and 3 are located to the west of CD-C and are not encroached upon by any of the other CIAA project boundaries.

The remaining white-tailed prairie-dog colonies within the CD-C project are in the "Block clearance" area, where surveys for black-footed ferrets are no longer warranted. The CD-C project area and RFFAs are not expected to exceed the impact significance criteria for black-footed ferret populations.

CHAPTER 5—CUMULATIVE IMPACTS



Map 5.9-1. Cumulative impact analysis area, black-footed ferret

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Greater sage-grouse. Approximately 60 percent of the CD-C project area is comprised of sagebrush and other shrub species, which represents potential greater sage-grouse nesting habitat. Recovery of shrubs, in locations that have been disturbed by development, to pre-disturbance levels is not expected to occur during the life of the project. Therefore, even locations that are successfully reclaimed would represent a long-term loss of nesting habitat; however, these areas would be used as early brood-rearing and foraging habitats throughout the seral stages.

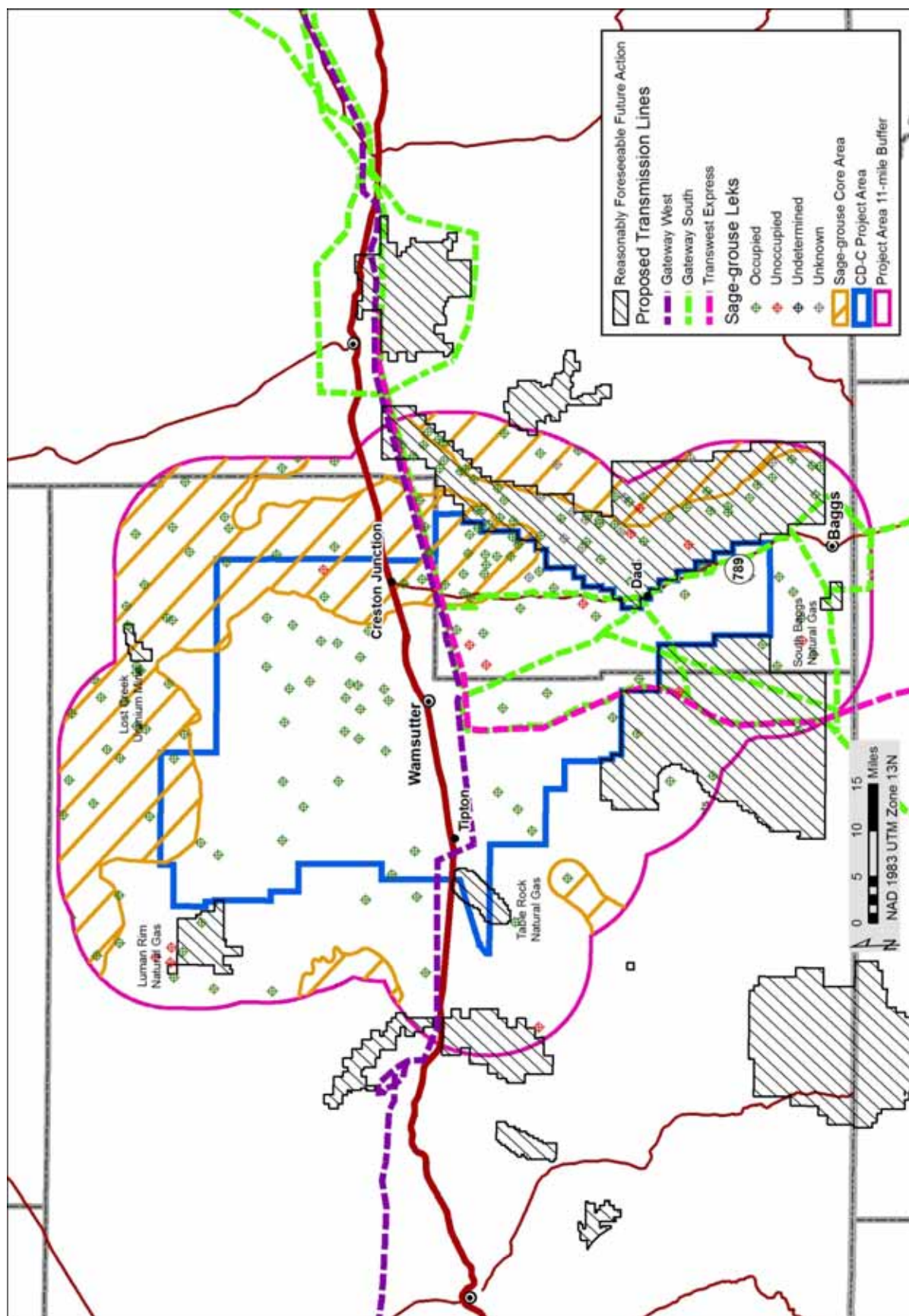
Per IM WY-2012-019, an 11-mile analysis area buffer is required around the project boundary for large-scale proposed actions (e.g. oil and gas full-field developments). This 11-mile buffer (**Map 5.9-2**) was used as the CIAA for greater sage-grouse breeding and nesting habitats potentially affected by the CD-C project and associated RFFAs, including the Luman Rim, Lost Creek, Desolation Flats, South Baggs, and Atlantic Rim projects. This area encompasses portions of the South Rawlins, Greater South Pass, Continental Divide, and Salt Wells Core Population Areas. Of these only the Greater South Pass and South Rawlins Core Population Areas would be directly affected by the CD-C project or RFFAs.

One-hundred ninety-two (192) known leks are located within 11 miles of the CD-C project area; 105 are occupied, 13 are unoccupied, and 74 have undetermined status (see **Map 3.9-2**). Another 67 known sage-grouse leks are located within the CD-C project area, for a total of 259 leks within the CD-C project CIAA. One-hundred sixty-eight (168) of these leks are occupied. All 259 leks would potentially be affected by the CD-C project or RFFAs as indicated on Map 5.9-2. Sixty-three (63) would possibly be directly affected by the CD-C project, 44 by Atlantic Rim, 18 by transmission line corridors and another 7 by various oil and gas projects. Other areas within the 11-mile buffer and associated Core Population Areas would be affected by scattered energy developments and anthropogenic features on the landscape.

Greater sage-grouse inhabit the CD-C project area and surrounding area year-round and require a wide range of seasonal habitats. The area of highest sage-grouse lek concentration in the 11-mile CIAA falls to the south of I-80 and east of WY 789, along the interface of CD-C and Atlantic Rim (**Map 3.9-2**). Approximately 81 occupied leks are known to be located in this area of high-quality/high-potential nesting and brood-rearing habitat. This area also contains large expanses of high-quality/high-potential severe winter use habitat.

Development activity may result in bird displacement and nest abandonment from direct and indirect impacts, such as long-term habitat fragmentation; loss of nesting or brood-rearing habitat; displacement or additional stress due to increased human activities including increased vehicle traffic, dust, excessive noise levels proximal to occupied leks; removal or modification of winter habitats; and increased predation due to an increased number of roosting sites available for raptors on power poles, tanks, and other man-made structures (see **Section 4.9.3**), especially in high-density development areas.

Regardless of the alternative selected, application of the Core Population Area density and disturbance limitations and mitigations (IM WY-2012-019 and SWED 2011) is intended to reduce disturbance to the habitat and the species to the point that sage-grouse populations within Core Population Areas are not negatively impacted. These restrictions would apply on all surface ownerships. Alternative D (100-Percent Directional Drilling) would reduce surface disturbance from road and well site locations by about 23 percent compared to the Proposed Action. Alternative E (No Action) would limit CD-C development activities to private and state mineral estates, thereby limiting additional impacts sage-grouse habitat and populations within the CD-C project area.



No warranty is made by the BLM for use of the data for purposes not intended by the BLM.

Map 5.9-2. Cumulative impact analysis area, greater sage-grouse

In non-core areas, application of applicable IM WY-2012-019 and SGEO (Greater Sage-grouse Core Area Protection program) standards for avoidance of potential nesting and brood-rearing habitat as well as the Rawlins RMP (BLM 2008a) standard COAs, BMPs, Timing Limitations, and mitigation would reduce the potential impact to sage-grouse but impact to those populations would still be anticipated. Alternative A would have the greatest potential for impact to non-core sage-grouse populations. Alternative B would provide enhanced mitigations and protections for sage-grouse as well as other high-value resources. Under Alternative C, the disturbance cap would place a limit on the amount of unreclaimed surface at any one time in a section of public land. Alternative D (required directional drilling on federal mineral estate) would reduce surface disturbance from road and well-site locations by about 23 percent compared to the Proposed Action. Restrictions applied for protection of sage-grouse habitat in non-core areas, found in IM WY-2012-019 and SGEO, would apply on state, fee, and federal lands. Alternative E (No Action) would limit CD-C development activities to individually permitted federal activities and private and state mineral estates, thereby limiting additional impacts to project area sage-grouse habitat and populations.

5.9.2 Threatened and Endangered Fish Species

Cumulative impacts to Threatened and Endangered fish species would include the effects of the CD-C project and other developments upstream in Muddy Creek, of which the most notable is the Atlantic Rim Natural Gas Project. At this time there are no known additional proposals to analyze or assess.

Four federally endangered fish species may occur as downstream residents of the Colorado River system: **Colorado pikeminnow** (*Ptychocheilus lucius*), **bonytail** (*Gila elegans*), **humpback chub** (*Gila cypha*), and **razorback sucker** (*Xyrauchen texanus*) (USFWS 2003). Suitable habitat for these species does exist downstream of the CD-C and Atlantic Rim project areas in the Little Snake, Yampa, and Green Rivers. Because the Colorado pikeminnow is found in the Little Snake River, it could migrate into Muddy Creek, which makes Muddy Creek potential habitat for this species. Muddy Creek, however, is not suitable habitat for this species. Neither of the action alternatives for these projects is expected to affect this habitat, provided that mitigation measures for water resources and soils outlined in this document are implemented. Though they currently exist only downstream of the project area, water draining from the project area affects the downstream habitat for these species. Under the Proposed Action, the sources of potential risks to these fish species are water depletions, discharges of produced water, and spills of toxic materials.

Water Depletions. Under the Recovery and Implementation Program for Endangered Fish Species in the Upper Colorado River Basin, “any water depletions from tributary waters within the Colorado River drainage are considered as jeopardizing the continued existence of these fish.” A small amount of water depletion may occur for the Atlantic Rim Natural Gas Project, and the Proposed Action may deplete an average of 510 acre-feet of water per year from aquifers in the Wasatch formation that may have contact with and contribute to the Little Snake River and its tributaries, including Muddy Creek.

Discharges of Produced Water and Spills of Toxic Chemicals. Produced water from the CD-C project area will not be discharged to Muddy Creek within the Little Snake River drainage; therefore, produced-water discharges will not pose a potential risk to these species. The Atlantic Rim project, however, has produced-water discharges to Muddy Creek that may be altering the hydrology of the creek.

Accidental releases (e.g., spills) of toxic chemicals also could occur. However, accidental releases of toxic chemicals should become highly diluted before they would reach any downstream waters where these species occur; consequently, the potential risks from such occurrences are negligible (BLM 2007).

5.9.3 Threatened and Endangered Plant Species

The CIAA for Threatened and Endangered Plants is the CD-C project area. As described in **Section 4.9.3**, direct impacts to the threatened Ute ladies'-tresses (*Spiranthes diluvialis*) are not anticipated to occur. The

application of the 500-foot buffer for riparian areas would provide protection for this species. If suitable habitat (i.e. riparian areas) were present, the proposal would be modified so impacts were avoided. The BLM stipulation for avoidance of riparian areas is not applied to state and fee energy development actions.

5.9.4 Sensitive Wildlife Species

Chapter 4 analyses determined that implementation of the Proposed Action or other analyzed alternatives is not expected to exceed the impact significance criteria for pygmy rabbit, swift fox, white-tailed prairie dog, Wyoming pocket gopher, bald eagle, burrowing owl, sagebrush obligate avian species, or mountain plover with the caveat that BLM mitigation measures be applied regardless of alternative selected. In addition, Alternative B provides enhanced protections for: greater sage-grouse leks, nesting/brood-rearing habitat, and winter concentration areas (**Section 4.9.3**) and ferruginous hawk nesting habitat. Alternative D reduces surface-disturbing activity by almost 23 percent compared to the Proposed Action.

The caveat regarding application of BLM mitigation measures for special status species would apply to all RFFAs as well as the CD-C project but would not apply to privately-owned checkerboard lands or state or private mineral estate in the CIAA. While some disturbance of these species would likely occur on private lands, it is not expected that impact significance criteria would be exceeded.

Ferruginous hawk. Concerns are identified (**Section 4.9.3**) regarding potential impacts to ferruginous hawk from disturbance to nesting/foraging habitats. The CIAA for raptors includes the CD-C project area plus a 1-mile buffer (see **Map 5.8-3**). This area covers approximately 1,226,825 acres, all of which would be considered raptor foraging habitat. Approximately 577 ferruginous hawk nests are known to occur in the buffered CD-C project area. Potentially positive cumulative impacts from the creation of additional nesting sites (i.e., artificial nesting structures including hydrocarbon stock tanks) are known from other conventional oil and gas projects in the vicinity of the CD-C project area. However, an undetermined number of active nest sites would not be protected by application of the BLM timing stipulation and 1-mile buffer on state and fee lands/minerals, especially in the “checkerboard.” Overall, because of the required buffers and restrictions on activity around raptor nests and because of the fact that most of the prey utilize habitat that can be reclaimed in a timely fashion, the impact on ferruginous hawks in the project area and associated RFFA overlap areas is not expected to exceed the significance criteria.

Sensitive Fish Species. Cumulative impacts to sensitive fish species would include the effects of the CD-C project and other developments upstream in Muddy Creek, of which the most notable is the Atlantic Rim Natural Gas Project. At this time there are no known additional proposals to analyze or assess.

Sensitive fish, described in **Section 4.9**, would be significantly impacted by both the CD-C and Atlantic Rim projects (Criteria 3 and 4). The types of impacts resulting from both projects would be similar and cumulative in their effects. The primary cause of impacts would be increases in suspended sediments and sedimentation. One difference in the Atlantic Rim project as compared to the CD-C project is that Atlantic Rim has produced-water discharges to Muddy Creek that may be altering the hydrology of the creek.

Impoundments downstream of the CD-C project may be blocking sensitive fish movement into Muddy Creek, but are not attributable to the CD-C project. As detailed in Chapter 4, additional impoundments and alterations to natural flow characteristics (such as crossings) within Muddy Creek could have serious additional impacts to fish populations. Alteration of hydrology from roads, culverts, and other disturbances that result in re-channeling of overland flows into new channels or increasing the intensity/volume of flows within existing channels can affect sensitive fish. Blockage of fish migration within the CD-C project area as a result of channel crossings would seriously impact the viability of fish populations if it should occur.

CHAPTER 5—CUMULATIVE IMPACTS

Alternative B, the Enhanced Resource Protection Alternative for the Muddy Creek Corridor/ Watershed described in **Section 2.2.3.4** could significantly reduce project impacts to sensitive fish species, if they were applied to both BLM and private and state land within the CD-C project area. Without the application of these protections to private and state land, however, the benefits of these enhanced resource protections could be negated by increased drilling activities on private and state land. Consequently, alteration of fish habitat suitability from increases in suspended sediments and sedimentation could result in significant impacts to sensitive fish species.

5.9.5 Sensitive Plant Species

The CIAA for sensitive plants is the CD-C project area. As described in **Section 4.9.3**, direct impacts to sensitive plant species on federal land are unlikely to occur because the potential presence of these species would be determined by soils survey or rare-plant surveys prior to site development. Management practices identified on a case-by-case basis would be applied to surface-disturbing activities to maintain or enhance Special Status Plant Species and their habitats (BLM 2008b, p. 2-47). Indirect impacts include dust affecting plant health and reproduction and invasive species being introduced in the adjacent habitat and competing with the sensitive plants.

Adjacent projects that could increase the dust and invasive species problem within the CD-C project area include Atlantic Rim on the east of the project area, Desolation Flats on the southwest, and Luman Rim on the northwest. Additionally, three transmission-line projects are proposed to cross the project area and vehicles/equipment associated with the planning and construction of those projects would provide other potential sources of dust and seed. The only sensitive plant that might be encountered during transmission-line construction is the Gibben's beardtongue. The surveys mentioned above should ensure that these plants, if encountered, would be avoided. The protections applied to sensitive species plants relative to BLM actions are not applicable to state and fee energy development actions.

5.10 WILD HORSES

The CIAA for wild horses includes the Lost Creek and Adobe Creek Herd Management Areas (HMAs). Impacts to wild horses associated with the CD-C project would include disturbed land and associated loss of available forage along with dust affecting forage palatability. There is also the potential for horse/vehicle collisions.

The Adobe Town HMA is generally located within the Desolation Flats Natural Gas Project area and impacts to the herd are more likely to happen in that area than in the CD-C project area. Two of the proposed transmission lines have potential routes through the Adobe Town HMA. During planning and construction, increased activity along their alignments would increase chances for collisions and generation of dust and remove small amounts of forage at the tower sites.

The Lost Creek HMA is located in the northwestern portion of the CD-C project area. It continues north from the CD-C boundary. The Luman Rim field is located to the west of the HMA and effects from vehicles accessing that field through the CD-C are possible. The Lost Creek HMA may also receive impacts from traffic associated with the Lost Creek Uranium Project.

■ HUMAN ENVIRONMENT

5.11 VISUAL RESOURCES

The CIAA for visual resources is the VRM Class III area within the CD-C project area. At roughly 1.1 million acres, the project area is large enough to enclose virtually all the potential foreground to middleground views of VRM Class III.

VRM Class III is the highest management classification within the project area. For the combination of landscape quality and viewer sensitivities prevalent within the project area, identifying visual impacts that might dominate a foreground to middleground view is critical to evaluating management actions for compliance with the VRM Class III standard. As described in **Section 4.11.2**, the RFO manages VRM Class III land for moderate change to visual resources by mitigating impacts through the use of BMPs as conditions of approval to APDs and right-of-way permits.

Cumulative actions that could affect VRM Class III in the CD-C project area are oil and gas development and electrical transmission line systems and rights-of-way. Development on BLM land combined with the same or similar actions on state and private land would result in cumulative visual impacts. Cumulative impacts would be especially likely to occur in the checkerboard and other areas of mixed ownership because BLM does not have the jurisdiction to mitigate these actions.

Cumulative impacts due to oil and gas development

Cumulative impacts due to oil and gas development would occur within the CIAA solely because of the CD-C project alternatives. No major oil and gas developments listed in **Table 5.0-1** overlap the CIAA.

Consistent with the analysis in Chapter 4, the greatest potential for cumulative impacts to visual resources from oil and gas development in the CIAA would occur under Alternative A, which would allow the highest level of surface disturbance.

Alternatives B through D would reduce the amount of surface disturbance due to oil and gas development. Alternative E, No Action, would generate no new surface disturbance. Alternative D would cause the least amount of surface disturbance among the action alternatives (as described in **Section 4.11.3.5**) by requiring the Operators to drill multiple wells from a single pad; multiple-well pads would not be required under the Proposed Action or other alternatives. Under Alternative E, much of the project area now affected by oil and gas development could gradually return to a reclaimed condition as oil and gas facilities on BLM land gradually become obsolete over time; therefore, the cumulative effect of Alternative E to scenic quality could be neutral to positive over the long term.

The actual visual contrast rating of wells, roads, and other facilities of the Proposed Action and action alternatives would be conducted after approval of the CD-C project, when development targets are identified and as the required site-specific APDs and right-of-way permits are evaluated. It is the site-specific location and intensity of development that actually determines the level of contrast perceived from a given view of the foreground to middle distance from a sensitive observation point. Site-specific location and intensity of development also determine the amount and type of mitigation required to achieve the management objective required by VRM Class III. This means that there is likely to be uncertainty for sometime as to whether cumulative impacts to specific viewsheds within the CIAA can be managed to a VRM Class III standard for the long term.

Even on federal land, the Operators' desired intensity and specific location of development could prevail over attempts to mitigate to a VRM Class III objective. This could occur despite BLM's mandate to implement measures to manage VRM Class III viewsheds. The BLM's authority to manage visual impacts in particular cases could be precluded when valid existing lease rights protect Operator activities. This limitation could leave a residual of unmitigated impact. In addition, parts of the CD-C project that target private and non-federal lands in areas of mixed land ownership are beyond BLM jurisdiction and

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could develop without adequate mitigation, leading to indirect impacts to visual resources on adjacent federal land

Developed areas where roads, well pads, tanks, and drill rigs dominate a view may accumulate within the project area to the detriment of existing rural landscapes that were previously intact. If this level of disturbance occurs and is viewable from sensitive observation points, the VRM Class III standard would be exceeded.

Cumulative impacts due to transmission lines

Two electrical transmission line projects listed in **Table 5.0-1** would cross VRM Class III parts of the CD-C project area: the Energy Gateway South Transmission Line Project (Gateway South) and the TransWest Express 600kV Project (TransWest). A third reasonably foreseeable transmission line from Table 5.0-1, Energy Gateway West, would cross only VRM Class IV land. Class IV land accommodates transmission lines by allowing a high level of modification to the existing landscape. Gateway South and TransWest are extended corridors that potentially would enter into many views as they traverse the CD-C project area. The three reasonably foreseeable transmission line projects are illustrated in **Figure 5.0-1**.

The Approved Rawlins RMP has provided for future utility development by designating the routes of existing transportation and utility lines as corridors that would be suitable for new transportation and utility ROW systems (ROD Map 2-2). The RMP also recommends the exclusion from the designated corridors of incompatible uses, among which are range and wildlife habitat improvements and any facilities “that would attract public use” (ROD p. 2-17). As they are shown on **Figure 5.0-1**, the preliminary alternatives for the proposed Gateway South and TransWest fall within designated corridors identified by the Rawlins RMP (ROD Map 2-2).

Although generally provided for by the Rawlins RMP, specific proposals for the Gateway South and TransWest projects would require site-specific environmental analysis and compliance with established permitting processes. Site-specific mitigation measures that could be applied during permitting to reduce the impact of transmission lines to a viewshed or to a specific observation point within the CD-C project area include properly siting latticed or appropriately colored towers against existing backgrounds or using topographical features to reduce visibility.

While effective when available, site-specific mitigation treatments are in fact limited in their utility for transmission lines because of what is typically the sparse, low-lying vegetation and flatness of the terrain in the CD-C project area. Therefore, the development of the Gateway South and TransWest projects would likely introduce strong vertical elements of an industrial character (tower structures) which would clash with the strong horizontal, natural elements (plains, rims, low vegetation and wide horizons) of existing settings within the CD-C project area.

The impact of the Gateway South and TransWest projects would likely be greatest where the utility ROW crosses or parallels travel routes. As shown on **Figure 5.0-1**, the southern extent of the western-most route alternative of the two transmission lines would cross interior BLM roads and the corridors of two historic trails, the Overland Trail and the Cherokee Trail. At those crossings, the transmission lines would adversely affect the viewshed of the roads and historic trails. Although the historic trail corridors are designated as “avoidance areas” for linear utility systems by the Rawlins RMP (Map 2-33b), a crossing of these corridors by a long-distance, north-south transmission line corridor is not explicitly excluded and may be impossible to avoid.

In addition, the southern extent of the easternmost route alternative of the Gateway South project would co-locate with the WY 789 corridor. The WY 789 corridor includes, at its south end within the CD-C project area, two topographical features known as Flat Top Mountain and The Bluffs. Although they are mostly of local interest to residents of Carbon and Sweetwater counties, these prominent features contribute to settings of moderate scenic quality, which is the highest level of scenic quality found within the CD-C project area (BLM 2011a). As prominent features, Flat Top Mountain and The Bluffs are focal

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points of foreground to middleground views that present themselves to travelers on WY 789 between Rawlins and Baggs, Wyoming.

The typical adverse impacts caused by a transmission line project are visual clutter in the foreground to middleground of a view and the visibility of the tall towers, which are 140 to 190 feet high for high-voltage lines of this type. From many perspectives, tower structures would rise above the CD-C project area's horizontal landforms and would likely appear prominently above the project area's wide skylines, perhaps competing with prominent natural features. Since high-voltage transmission lines are industrial in character, introducing such facilities would alter the scenic quality of existing VRM Class III viewsheds that would be affected by the Gateway South or TransWest projects within the CD-C project area.

Cumulative impacts conclusion

The combination of CD-C project oil and gas development and the development of the Gateway South and TransWest transmission line right-of-way systems in the area south of I-80 and west of WY 789 could combine to create a high cumulative impact in some viewsheds in the VRM Class III parts of the CD-C project area. In addition, development of oil and gas facilities throughout the CD-C project area may expose existing VRM Class III areas to under-mitigated, site-specific visual impacts. These could accumulate within a given viewshed because of minerals lease terms that limit the BLM's ability to mitigate visual impacts or because of the BLM's lack of jurisdiction over visual resources management in mixed ownership areas.

Visual impacts from these two kinds of planned or reasonably foreseeable development may add up to a high enough level of incompatible contrast with existing settings to be non-compliant with VRM Class III. If this occurs repeatedly in a number of VRM Class III areas of the CIAA, BLM may find it necessary to reconsider its resource allocation decisions through an RMP amendment process. This could lead in the future to an amendment of the RMP and a new set of resource allocations that would expressly lower VRM management classifications as needed to reflect the cumulative impact of development on the condition of the visual resources of the CIAA.

5.12 RECREATION

The CIAA for recreation is the Western Extensive Recreation Management Area (ERMA) of the RFO. The CIAA/ERMA covers all public land in the RFO west of Rawlins.

The recreation resources of the CIAA are those of the CD-C project area plus areas beyond the project area that include more of the same Hunt Areas, big game Herd Units, wild-horse management areas, contiguous blocks of public lands, and interconnected public roads. These combined resources support the recreation values of concern for the cumulative impacts analysis, namely big game hunting and dispersed, non-consumptive recreational uses that center on wild horses, other wildlife, and the character of the landscape.

Projects potentially affecting recreation in the CIAA are the CD-C project and other projects identified in **Table 5.0-1**. Other existing and reasonably foreseeable future projects are the Atlantic Rim Natural Gas Field Development, the Desolation Flats Natural Gas Development, the Luman Rim natural gas project and the Sierra Madre part of the Chokecherry and Sierra Madre Wind Energy Project.

Cumulative impact to hunting, which is the main recreation activity in the CIAA, would occur as surface disturbance from development of the CD-C and other projects accumulates. Cumulative impact to hunting recreation begins with displacement of big game species within Hunt Areas because of disturbance to critical habitat and development activity within those habitats at key times of year. Cumulative impacts to hunting recreation also may include impacts to big game populations at the herd level of the primary big game targets in the CD-C project area, pronghorn and mule deer, because of long-term disturbance to sagebrush habitat.

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When big game species leave a Hunt Area, hunters soon leave as well, because hunting success declines. If Herd Units are affected, the animals available for harvest and therefore the supply of hunting recreation, as reflected in the number of licenses issued, may decline. The potential for cumulative effects to Hunt Area displacement and potentially reduced availability from the herd is perhaps highest for pronghorn pronghorn hunting. As indicated by **Table 3.8-1**, estimated populations in the largest pronghorn Herd Units of the CIAA (Red Desert Herd Unit north of I-80 and Bitter Creek Herd Unit south of I-80) had a slightly decreasing population trend from 2001 to 2009 and an estimated population lower than the objective in 2009. Mule deer also may be affected by cumulative, long-term disturbance of habitat.

There are also indirect impacts associated with hunting in the CIAA that may arise as development disturbance and activity accumulate. One is the potential for financial impact to big game outfitters whose commercial success depends on access to, and hunter success in, the CIAA. Another is potentially lower hunter safety because of higher accident risk as hunter density rises where displaced game has concentrated. Finally, some hunters wishing to avoid industrial facilities locations for safety and aesthetic reasons may find it more difficult to do so as development density rises in the CIAA; this would raise the likelihood of a lower-quality experience for some recreational hunters.

Relatively undisturbed scenery is an integral part of the recreation experience for activities such as wildlife viewing. Accumulating development would decrease the availability of this type of recreational setting throughout the CIAA, so recreationists seeking natural-appearing landscapes would have to travel elsewhere and perhaps for greater distances as the CD-C and other projects are fully developed over time and before landscapes are fully reclaimed.

The re-establishment of mature vegetation after final reclamation would take as much as 30 years in some parts of the CIAA. Localized areas may not achieve successful revegetation for much longer. With project lives of 45 to 55 years underway or reasonably foreseeable, the CIAA is not likely to be fully reclaimed for habitat or appearance for 70 to 80 years from its initial status. Long-term cumulative impacts in the CIAA would be likely to affect from two to four generations of hunters, wildlife viewers, and dispersed recreational users that value solitude in a natural-appearing landscape.

The greatest cumulative impacts to recreation would occur under Alternative A because of increased surface disturbance and less protection to visual resources, which contribute to the recreation setting. Cumulative impacts to recreation would be less under all other action alternatives within the CD-C project area, which implies lesser impact to the recreation resources of the CIAA as a whole.

Under Alternative E, No Action, the recreation resources of the CD-C project area, which in turn is a large part of the CIAA for recreation as a whole, could gradually improve as new oil and gas development is avoided and as existing oil and gas facilities gradually become obsolete over time and are reclaimed.

Under Alternative E, No Action, the recreation resources of the CD-C project area, which in turn is a large part of the CIAA for recreation as a whole, could gradually improve as new oil and gas development is avoided and as existing oil and gas facilities gradually become obsolete over time and are reclaimed.

5.13 LANDS WITH WILDERNESS CHARACTERISTICS

No Lands with Wilderness Characteristics have been identified within the CD-C project area.

5.14 CULTURAL AND HISTORICAL RESOURCES

The CIAA for cultural and historical resources is the CD-C project area. Archaeological sites generally are located in discrete areas and effects on these sites are a consequence of implementing surface-disturbing activities associated with a development proposal. Impacts from past and present actions within

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the project area could occur as a result of the following mineral development projects which overlap the CD-C project area: Continental Divide, Continental Divide/Wamsutter II, Creston/Blue Gap, and Patrick Draw. In addition to the Proposed Action, impacts from reasonably foreseeable future actions (**Table 5.0-1**) include three transmission lines: the TransWest Express, Gateway West, and Gateway South. The TransWest Express is proposed to run from Sinclair, Wyoming to southern Nevada. The proposed route would begin just south of I-80 and east of Rawlins, heading west-southwest into the project area, and turning south in Sweetwater County toward the Wyoming/Colorado border. In all, the proposed route would traverse approximately 45–50 miles within the project area. The Gateway West transmission line from Glenrock, WY to Idaho would bisect the project area from east to west, running to the south of and roughly paralleling I-80 until approximately 10 miles from the western boundary, where it would turn northwest across I-80, and then west toward Rock Springs. Approximately 72 miles of the route would lie within the project area. The Gateway South transmission lines would also originate in Glenrock, following the same route as Gateway West into the project area, and then splitting into multiple routes running south toward Nevada (**Map 5.0-1**). In all, approximately 140 miles of routes would cross the southern portion of the project area. Assessment of impacts from these transmission lines would be speculative at this time since the final routes have not been approved.

Given the average site density of .04 cultural sites per acre, approximately 1,888 sites could be located within accumulated disturbance areas for the Proposed Action compared to 2,467 for Alternative A; 1,821 sites for Alternative B; 1,718 sites for Alternative C; 1,458 sites for Alternative D; and no sites for Alternative E, No Action. It should be noted that sites are not evenly dispersed throughout the study area, but are typically found along the major drainages and lower benches of escarpments that dominate the terrain in the project area.

In addition, segments of the Cherokee and Overland Trails, the Lincoln Highway/Union Pacific Grade, and the historic Rawlins-Baggs Road traverse the project area. These segments, including those that contribute to overall eligibility for listing on the NRHP, are summarized in **Table 5.14-1**.

Table 5.14-1. Historic trails and roads in the CD-C project area

Trail/Road	Total Miles, All Segments	Total Miles, NRHP- Contributing Segments
Overland Trail	22.49	14.08
Cherokee Trail	13.32	4.49
Lincoln Highway/Union Pacific Railroad Grade	45.24	16.24
Rawlins to Baggs Wagon Road	15.18	0.00

Source: D. Johnson, Western Archaeological Services, personal communication; 2011.

As directed by law, cultural resources inventories and consultations would be conducted for any projects involving federal lands, and adverse effects to NRHP-eligible sites would be avoided or mitigated as appropriate. All activities associated with the Proposed Action would be in accordance with federal laws and agency guidelines. Impacts to any previously unknown NRHP-eligible sites that may be discovered during construction activities would be mitigated in accordance with this EIS. Although sites located within disturbance areas are avoided or mitigated, sites located outside of and adjacent to disturbance areas are vulnerable to indirect impacts such as vandalism, illegal collection, dust, and erosion. It is anticipated that there would be a cumulative increase in vandalism, illegal collection, and dust due to the increase in roads throughout the entire natural gas field, and increased erosion at sites located in the vicinity of well pads and associated pipelines where vegetation cover has been reduced or eliminated.

5.15 SOCIOECONOMICS

The CIAA for socioeconomic conditions includes Carbon and Sweetwater Counties. Given Rock Springs' position as a regional service center for the natural gas industry in southwest Wyoming, the indirect effects of past, ongoing, and reasonably foreseeable future effects of regional natural gas development are also considered.

Within the project area, 224 new wells were drilled during 2010 and an estimated 3,738 wells were in production at the end of 2010. Production activities, maintenance and workover expenditures, employment, and tax revenue generation associated with these wells will be ongoing, regardless of which alternative is selected by the BLM. Because much of the infrastructure to support this level of drilling and production is in place, ongoing production activities, expenditures, and employment associated with wells currently in production are considered part of both the baseline and cumulative effects analyses.

Past and current natural gas drilling and production in the project area and elsewhere in the CIAA have resulted in the development of substantial infrastructure capable of supporting future development and production. In some cases this infrastructure has excess capacity relative to the current (mid-2011) levels of development. Examples of infrastructure put in place to support past and ongoing development include the natural gas operator and service company operations yards in Rock Springs, Wamsutter, Rawlins and Baggs, described in **Section 3.15.1.1**, as well as pipelines, service roads, and other ancillary facilities. Past and ongoing activities have also resulted in human resource development, such as a cadre of employees in natural gas drilling, production, and support companies. Finally, natural-resource and other industrial development has supported construction and operation of substantial commercial and public infrastructure in communities in the CIAA. This industrial, human, commercial, and public infrastructure is capable of supporting a certain level of ongoing and future natural resource and industrial development activity and serves as a base for expansion of capacities to support higher levels of development.

A number of the reasonably foreseeable projects identified in **Table 5.0-1** require regulatory approval to proceed. If approved, the wind energy, transmission line, and other projects could contribute to cumulative socioeconomic effects in specific areas of the CIAA. The potential for adverse cumulative effects such as labor force competition, housing shortages, and strained community infrastructure and services would occur primarily in the event of concurrent construction of these projects. The potential beneficial cumulative effects, including increases in tax revenues, would be longer-term.

In contrast, the reasonably foreseeable natural gas projects, both currently approved and as yet unapproved, would contribute to cumulative socioeconomic effects over longer time periods and would affect socioeconomic conditions in a broader portion of the CIAA.

Although each of the natural gas projects identified in **Table 5.0-1** has or will have an assumed pace of drilling and development identified in the relevant NEPA document, as noted in **Section 4.15.2**, the actual pace of natural gas development in southwest Wyoming is variable and unpredictable because development depends on a variety of factors including energy demand, pricing, regulatory approvals, rig and manpower availability, transmission pipeline capacity, weather, and the investment and development strategies of individual energy companies. Consequently, the potential for cumulative socioeconomic effects would be greater during extended periods of natural gas demand.

In the eastern portion of the CIAA, identified cumulative projects by 2020 include construction of the proposed Chokecherry and Sierra Madre (CCSM) Wind Energy Project, the Gateway West, Gateway South and TransWest Express transmission line projects, the Lost Creek In Situ Uranium Project, and the Medicine Bow Fuel & Power Coal-to-Liquids (CTL) Project.

The proposed CCSM Wind Project would primarily affect the Rawlins portion of the socioeconomic CIAA, although some construction workers might also seek housing in Rock Springs and the Wamsutter and Baggs areas. Due to timing stipulations related to wildlife, active construction would likely occur

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during a six-month period of three or four consecutive years, with 800 to 1,200 construction workers during the peak periods. Consequently, the potential for adverse temporary and short-term cumulative socioeconomic effects during construction would be high. Once construction is complete, socioeconomic effects would be largely beneficial.

Construction of the TransWest Express, Gateway West and Gateway South transmission line projects could each affect one or more communities in the region, depending on routing, as the construction workforce moves through the area over one or two construction seasons. The effects would again be associated with demand for housing, community services, and fiscal effects related to project activity and the construction workforces. Operating work-force requirements of the wind energy and transmission lines are substantially smaller than the construction workforce needs.

The Lost Creek In Situ Uranium Project would affect Bairoil and Rawlins during construction and operation.

The Medicine Bow Fuel & Power CTL Project, a combination mining and industrial project, could create cumulative socioeconomic effects in Rawlins and other communities in Carbon and Albany Counties located outside the CIAA. This large project poses a potential for cumulative socioeconomic effects in Rawlins during the multi-year construction phase and initial staffing period for project operation. Once full-scale operations begin and housing and public infrastructure and services are in place to serve demand, the socioeconomic effects would be largely beneficial.

The Bridger Mine expansion and proposed Sweeney Ranch, White Mountain, and Bridger Butte wind energy projects would primarily affect western Sweetwater County and the communities of Rock Springs and Green River. In the case of the Bridger Butte project, Uinta County and its communities could also be affected. The expansion of the Bridger Mine is ongoing and most socioeconomic effects of the project were considered in the baseline. Adverse socioeconomic effects of the wind energy projects would occur primarily during construction, with beneficial effects occurring as tax revenues began to flow to local and state governments.

The final construction schedules for the proposed wind energy, transmission line, mining and other projects listed in **Table 5.0-1** will not be known until they receive the required authorizations, approvals, and financing. It is also not possible to predict with accuracy the level of natural gas drilling that will occur in southwest Wyoming during the construction period for these projects.

If construction for all or some of these projects were to overlap concurrently with an increase in natural gas drilling levels to 2007–2008 levels, another “boom” could ensue in the CIAA. In that case, cumulative impacts on area socioeconomic conditions would include short-term and long-term positive effects on local economic conditions, increased employment opportunities and increased local and state government tax royalties.

Adverse effects would include demand for temporary and long-term housing resources that substantially exceed local supplies, demand for local government services that exceed some service capacities, and changes in local social conditions that could include social disruption in some communities. Increased employment opportunities in relatively high-paying construction and energy-development jobs would result in competition for workers to the detriment of existing businesses and government agencies that could lose existing employees and experience difficulty recruiting new employees. On the other hand, workers would benefit from the increased wages that would result from this competition, while simultaneously potentially facing higher costs of living.

Shortfalls in temporary housing availability could be mitigated by development of temporary housing facilities. Medicine Bow Fuel & Power has proposed such facilities to accommodate construction workers on its CTL Project and the Power Company of Wyoming has indicated it would consider providing such facilities for CCSM. It is also becoming increasingly common for natural gas Operators and drilling

companies to develop temporary housing; three such facilities, several rig camps, and the placement of dormitory units in local mobile-home parks were operational near the project area in 2007–2008.

The pace of residential construction in most communities in the CIAA would need to increase substantially to accommodate cumulative demand for longer-term housing units, were several of the projects listed in **Table 5.0-1** to overlap with an increase in natural gas development activities.

Demands on housing and local government services associated with some of the wind energy and transmission line projects and natural gas development would be seasonal, presenting staffing challenges for counties and communities. Excess capacity exists in many public-utility infrastructure systems (e.g., water and wastewater systems) in the communities that would likely host the bulk of the construction and natural gas development workforce. Recent experience in the CIAA has been that relatively few families and school-age children have accompanied construction and natural gas workers to the area; consequently, local school districts could likely accommodate cumulative enrollment with existing facilities in the near term. In the longer term some schools may need to add or expand facilities and the lead-time to secure approval and funding from the Wyoming School Facilities Commission and plan and construct school facilities could mean that certain facilities would experience crowding until new facilities are available.

Community services such as law enforcement, emergency response, social services, and road and bridge departments, which in some cases experienced reductions in funding levels, service provision, and staff cutbacks in recent years, would initially face constraints in responding to increased demand. For most projects, local receipts of sales and use tax revenues lag the increases in demand. In other cases, a jurisdictional mismatch could occur between jurisdictions benefitting from tax revenue accrual and those facing the demands. This lack of revenue, coupled with competition for workers and the difficulty in staffing for seasonal demand, would present substantial challenges for local governments in the early years of a boom.

When ad valorem and production-related revenues—and for wind energy projects, energy production tax revenues—begin to flow from the cumulative projects, counties and special districts (and in some instances, school districts) will benefit from substantially increased revenues. However, municipalities will not benefit directly from these revenues.

Cumulative development in the CIAA also holds potential to affect local attitudes, opinions, and lifestyles and these effects are likely to be mixed. Development of the wind energy, transmission line, mining, and other projects listed in **Table 5.0-1**, coupled with a moderate increase in natural gas development, would result in economic growth and increased employment opportunities in relatively high-paying jobs. These changes would create the prospect for improved financial status of many residents, which would correspondingly increase support for cumulative development activities, particularly among those segments of the community that would benefit directly or indirectly from the increased economic activity. On the other hand, dissatisfaction may occur among those residents whose economic activities and/or recreation activities rely on use of the same geographical areas as the Proposed Action and projects listed in **Table 5.0-1**, including ranchers, grazing operators, outfitters, hunters, and other recreationists. Moreover, if area residents perceive that wildlife habitat, scenic vistas, and other resources are being degraded by development, levels of dissatisfaction could become greater and more widespread.

Given the cyclical nature of natural gas development and the potential for other energy development to occur, it is difficult to predict development and associated population levels with any certainty. Following population gains in response to cumulative construction activities, population in the CIAA would decline as construction is completed, perhaps dramatically in the event of multiple concurrent construction schedules. Exceptions to this pattern would include the mining projects and the Medicine Bow Fuel & Power CTL project, which have relatively large operating workforce requirements. If employment and population were to fall dramatically, businesses that expanded or opened to accommodate the temporary population influx would need to transition to accommodate the decreased demand. Some business

closures would be likely. Effects on area housing conditions could range from moderate to severe, depending on whether the construction and natural gas development demands were accommodated in temporary housing or if housing to accommodate the temporary workforce was developed with a post-boom use in mind. In those cases, communities in the CIAA could reduce the amount of unoccupied temporary housing after construction is completed or if a slowdown in natural gas development were to occur. Similarly, the fact that most community infrastructure including water and sewer systems is already in place should help communities avoid substantial debt that would be difficult to service when population levels decrease.

5.16 TRANSPORTATION

The CIAA for transportation includes western Carbon County, eastern Sweetwater County, and the highway transportation network providing access to and within the project area. Cumulative effects on transportation would include changes in traffic volumes. These changes, when combined with traffic associated with the CD-C project, would affect overall travel conditions on the CIAA transportation network. Past, ongoing, and reasonably foreseeable activities expected to produce incremental and cumulative impacts within the CIAA are summarized in **Table 5.0-1**.

Historic and ongoing traffic within the project area is associated primarily with natural gas drilling and production, grazing, and outdoor recreation. Within the project area, 224 new wells were drilled during 2010 and an estimated 3,738 wells were in production at the end of 2010. Production-related traffic associated with these wells will continue for their remaining productive life and during abandonment and reclamation, regardless of which alternative is selected by the BLM. Using the trip-generation factors developed for this assessment, an estimated 726 AADT would be associated with drilling under the Proposed Action in the peak year and an estimated 798 AADT associated with production activities in the peak year.

Within the project area, the reasonably foreseeable actions that could result in cumulative transportation impacts would be the previously authorized Desolation Flats and Luman Rim natural gas projects.

Two county roads serving the project area also provide access to the Desolation Flats project area (DFPA): SCR 23/CCR 701 (Wamsutter–Dad Road) and CCR 700. Although these two roads have served development in both the project area and the DFPA for years, incremental increases in traffic on these roads could occur if natural gas demand and prices support an acceleration of drilling and field-development activities.

Cumulative effects on county roads associated with the Luman Rim project are not anticipated. Primary access to the Luman Rim project area (LRPA) from I-80 is via SCR 21, which is outside the project area. It is possible to access the LRPA via two roads that traverse the CD-C project area; SCR 67 travels north from I-80 and intersects with SCR 20, which then exits the project area to the west and intersects with SCR 21 south of the LRPA. However, the longer travel distance from I-80 associated with this route discourages its use to access the LRPA for all but contractors and vendors who may be traveling to/from the LRPA from other job worksites within the CD-C project area.

All of the projects listed in **Table 5.0-1** could generate traffic increases on I-80, particularly during construction, although some of the affected sections of I-80 would be outside of the CIAA. Under an accelerated drilling scenario, periods of traffic impedence and congestion could be anticipated, and some increases in the number of accidents could be anticipated. Cumulative traffic effects could also increase road maintenance requirements for WYDOT and for both county road and bridge departments.

The highest volume of incremental traffic on I-80 would likely be in conjunction with the CCSM Wind Energy project, proposed for development south of Rawlins. Materials, equipment and supplies deliveries for the CCSM project are anticipated to arrive by rail and be offloaded at an intermodal facility located

either southeast of Sinclair or on the south side of I-80 west of Sinclair, which would result in relatively little cumulative truck traffic on I-80. However, daily commuting by workers and others, including trips by contractors, would result in incremental traffic on I-80. One option under consideration by the Power Company of Wyoming includes housing construction workers in Rock Springs and Laramie. Workers commuting from/to these communities to the CCSM project area would contribute to cumulative traffic effects on I-80 between Rock Springs and Rawlins or east of Rawlins for six to eight months during each of the anticipated four-year construction periods. These effects would be minimal given the substantial baseline volumes of traffic on I-80 in these locations.

The Medicine Bow Fuel & Power CTL Project and the Sweeney Ranch, White Mountain, and Bridger Butte wind energy projects are all located some distance from the project area. The TransWest Express, Gateway West and Gateway South transmission line corridors projects pass through the project area, and some substations and ancillary facilities may also be located within the project area. Construction equipment, supplies, and materials for these projects could be transported by rail or, for the CTL project and some segments of the transmission projects, via US 30 from Laramie. Transport of materials, equipment, and supplies to these projects would also occur on I-80 and, when considered in conjunction with the forecast traffic for CD-C, would generate cumulative traffic increases on the highway. Large increases would occur primarily during construction of these projects and would therefore be temporary and short-term in nature.

Construction and operations of the Lost Creek In-Situ Uranium Project could contribute to cumulative traffic impacts along I-80, although materials coming from the north—e.g., from Casper—would likely access the Lost Creek project via US 287. Construction and operations materials coming from the east or west on I-80 would travel through Rawlins to access US 287, and a portion of the project's construction and operations workforce would likely reside in Rawlins. Both of these scenarios would result in cumulative transportation effects within the city if the Lost Creek project's construction schedules were to coincide with natural gas development within the CD-C project area. Given the relatively minor increases in CD-C-related traffic anticipated for US 287, no substantial adverse cumulative impacts are anticipated.

Development associated with the previously approved Atlantic Rim Natural Gas Field Development Project would also use WY 789 to access the western portions of its project area. Cumulative transportation impacts would be anticipated for WY 789 between Creston Junction and Baggs, particularly during periods when market conditions promote higher levels of new development activity in the Atlantic Rim and CD-C project areas. Under an accelerated drilling scenario, periods of traffic impedance and congestion could be anticipated, particularly around the Dad area.

All of the natural gas projects listed in **Table 5.0-1** would generate additional traffic on I-80. If there were a regional acceleration of drilling and development in response to sustained high sales prices for natural gas, those increases could be substantial.

5.17 NOISE

The CIAA for the discussion of Noise is limited to the CD-C project area due to the localized nature of this issue. Noise will continue to be generated by project area operations for the life of the field.

Cumulative impacts of the Proposed Action and action alternatives include the addition of development- and production-related noise sources to those that already exist within the project area. These noise sources include, but are not limited to the I-80 corridor, the railroad, gas compression, fluid transport by truck, gas-stabilization equipment, hydrocarbon production, and maintenance activities. In some areas the density of development could be considered by some individuals to be “noisy.” This continual (though likely low-level) noise may be disruptive or objectionable to individuals such as recreationists or livestock operators and may result in displacement of such activities. Displacement of wildlife in general and

sensitive wildlife species may also occur in “busy” or “noisy” areas in the greater CD-C field-development area; refer to **Sections 5.8** and **5.9** for this discussion.

■ MANAGEMENT ENVIRONMENT

5.18 RANGE RESOURCES

The CIAA for range management includes the entire area of all of the allotments that are located within or partially within the CD-C project area. The number of well pads projected for the action alternatives varies from a high of 8,950 under Alternative A (100-Percent Vertical Drilling) to a low of 4,032 in Alternative D (Directional Drilling). Many of the allotments in the southern portion of the CD-C project area cross the project boundary into other natural gas developments (Atlantic Rim on the east and Desolation Flats on the west). One allotment managed by the Rock Springs Field Office has minimal acreage within the CD-C project area, as well as acreage in the Luman Rim natural gas project.

Those allotments that cross into the other project areas would have impacts from both natural gas projects including forage loss, reduced palatability of forage from dust, potential damage to fences and other improvements, possible increase in invasive plant species that can out-compete native vegetation and poison sheep, possible collisions, and increased difficulty in management of stock (gates left open, etc.).

Depending on the location of well pads and the number of locations and associated facilities, some of the allotments may reach the level of significance for loss of AUMs described in **Section 4.18.2**. Surface-disturbance totals described in **Table 3.18-2** would likely be higher for allotments that are affected by developments in addition to the CD-C project. It is possible that in these allotments, the combination of impacts from several projects could result in the loss of AUMs that reached the level of significance, which if not mitigated by range-improvement projects, could result in a reduced number of livestock being permitted on the allotment.

Construction of the three transmission lines planned to cross the CD-C project area and development of adjacent oil and gas fields may cause many of the same indirect impacts identified above and would increase overall impacts on the affected allotments.

5.19 OIL AND GAS AND OTHER MINERALS

The CIAA for oil and gas and other minerals is southwestern Wyoming. The natural gas fields of the CD-C project area make up the largest single—but not the only—source of oil and gas in the analysis area. The Atlantic Rim, Desolation Flats, Luman Rim, Table Rock, Moxa Arch, and Hiawatha project areas are among the other sites of fluid mineral development in the analysis area. The production from all these project areas is transported out of the analysis area by pipeline to national markets. Many of the same Operators that develop natural gas in the CD-C project area also work in other fields in the analysis area. Employees, facilities, and infrastructure of one Operator are often utilized in support of various projects within the analysis area.

5.20 HEALTH AND SAFETY

The cumulative impacts analysis area for the discussion of Health and Safety includes all Reasonably Foreseeable Future Actions listed in **Table 5.0-1**. Two aspects of safety—increased traffic and additional natural gas pipeline construction—are common to all activities across southern Wyoming. These issues are long-term in duration and would continue as part of project area operations for the life of the field, approximately 45 to 55 years.

CHAPTER 5—CUMULATIVE IMPACTS

Cumulative impacts of the Proposed Action would include the addition of vehicles associated with natural gas development and the other reasonably foreseeable activities to the interstate highway and local road systems. The additive number of semi-truck rigs and passenger vehicles would add to the risk of collision for the project workforce as well as the general public. I-80 will continue to be a major east/west transportation corridor for all aspects of transportation including materials needed for continued gas-field development and operations, as well as transportation of materials from the field including produced condensate, produced water, and solid wastes; refer to **Section 5.16 Transportation and Access** for this discussion.

Natural gas pipelines may be constructed or enlarged to accommodate the volume of gas being produced across the southern tier of Wyoming. Conversely, as fields are depleted, gas production declines and pipelines may be abandoned; refer to **Section 5.16** for this discussion.

5.21 WASTE AND HAZARDOUS MATERIALS MANAGEMENT

The cumulative impacts analysis area for the discussion of Waste and Hazardous Materials Management includes all Reasonably Foreseeable Future Actions listed in **Table 5.0-1**. Wastes will continue to be generated and hazardous materials will continue to be used in the project area operations for approximately 45 to 55 years, the anticipated life of the field.

Cumulative impacts of the Proposed Action include: the addition of wastes generated from 15 years of operating man camps, drilling and completion of 8,950 additional wells, and the associated produced water. Over its lifetime the project would add significantly to the volume of solid waste, drilling and completion operations wastes, and produced water, as well as to the wastes generated from well-site and pipeline compression and liquids stabilization facilities. The need to appropriately dispose of these wastes would significantly stress the existing permitted capacity of local municipal and third-party disposal facilities and would necessitate the permitting and construction of additional disposal facilities in proximity to the project area. The cumulative impacts would be similar for all the analyzed alternatives, although at a reduced level for the No Action alternative.